## 

### **Table of Contents**

#### **Preface**

### **Chapter 1: Properties and Treatment of Structural Metals**

Using Artificial Neural Networks to Predict Hardness and Impact Toughness of Aluminum Alloy 6061-T6	
O. Bataineh and M. Smadi	3
Effect of Co on Microstructure and Properties of Al-30%Si Alloys X.S. Li, W.Y. Zhong and R. Liao	14
Comparative Study of the Mechanical Properties of Spot Welded Joints M.S. Fakhri, A.M. Al-Mukhtar and I.A. Mahmood	20
Experimental Investigations of Surface Finish Generated by Wire Electrical Discharge Machining	20
A.H. Hadi and A.A. Khleif  Experimental Investigations of Hydrodynamic Poor Proving of Colvenized Steel to Form a	28
Experimental Investigations of Hydrodynamic Deep Drawing of Galvanized Steel to Form a Hemispherical and Complex Cup A.R. Ahmed and A.A. Khleif	38
Investigation of Fatigue Behavior for Al/Zn Functionally Graded Material Z.M.R. Al-Hadrayi, A.N. Al-Khazraji and A.A. Shandookh	48
<b>Alumina Nano Powder Impact on Electrical Discharge Machining of Titanium Alloy Wire</b> F.N. Abed	56
Chapter 2: Polymers and Composites	
Natural Hybrid Reinforcement Effect on Mechanical Properties of UPE Composite W.N. Alrawie, Z.N.R. Alraziqi and Q.A. Hamad	67
Developing Crumbed Rubber Tires / Epoxy Composite, by Surface Treatment with Different Silane Coupling Agents	77
J.I. Abdulhameed, A.Ĥ. Ali and I.H. Kara  Numerical and Experimental Study of Multi-Layer Armors for Personal Protection	77
A. Ehsan, A.O. Samarmad and A.F. Hamzah	84
Hardness and Dry Sliding Wear Characterization of Functionally Graded Materials	
Employing Centrifugal A.M. Abdulmajeed and A.F. Hamzah	94
The Effect of Filler and Fiber Type on the Behavior of Body Armor Composite S.T. Alhaddad, J.J. Dawood and F.M. Mohammed	105
Enhancement Mechanical, Thermal and Dielectrical Characteristics of Polystyrene Reinforcement by Glass Fiber and Additive Kaolin	
R.A. Kareem, M.A.I. Alqadoori and M.M. Ismail	114
Enhancement the Crashworthiness Parameters Using Natural and Hybrid Composites under Axial Static Crushing	
Z.F. Albahash, M.J. Sharba and B.A. Hasan	122
Enhancement Mechanical Properties of Polymers Reinforcing by Nano Graphene K.A. Handoul and A.A. Taher	133
The Compatibility Characterization of PMMA/DPET Based Polymer Blend D.S. Saleem, M. Alzuhairi and N.A.H. Nassir	141
Improvement of Tensile and Flexural Properties of Fiber Pre-Stressing Composite by Using Nano Graphene L.A. Madi and A.S. Alithari	150
20. 21. 2. 24. 24. 24. 24. 24. 24. 24. 24. 24.	150

### **Chapter 3: Protective Coatings**

The Physical-Mechanical Properties in Aggressive Media of Epoxy Composite Reinforced with Waste Glass Materials  I.I. Kadhim, B.M. Fahad and A.M. Hameed  Effect of Multi-Walled Carbon Nanotubes (MWCNTs) in Reducing the Corrosion Rate in Cr-MWCNTs Composite Coatings  N.M. Dawood, A.M. Nattah and T.A. Jasim  The Influence of Thermo Mechanical Treatment on Corrosion Resistance of Cu-Al-Ni Shape Memory Alloy  H.A. Dawood and R.S.A. Adnan  Boriding Treatment of Low Alloy Steels: Effect of Holding Time and Temperature  Y. Kermiche and Y. Benarioua  Indirect Production of Chromium Carbides Film on Low Alloy Steel  Y. Benarioua  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs  K. Al-Marzoki, N.Z. Whicb and F.J. Hmood  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs  K. Al-Marzoki, N.Z. Whicb and F.J. Hmood  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs  K. Al-Marzoki, N.Z. Whicb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization  S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  229  Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study  A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design  A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents  I. Al-Sharuee and B.R. Ali  Morphological and Optical Study of Black P-Silicon Textured in KOH Bath  I. Michaphim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  260  In <sub>2</sub> O <sub>3</sub> /MoS <sub>3</sub> /Reduced Graphene Oxide Nanostructures as Composite Electrodes for Supercapaci	Study the Fatigue Corrosion Behavior of Turbine Blade by Laser Cladding Z.A. Abdulwahab, S.I. Jafar and S.A. Ajeel	163
Effect of Multi-Walled Carbon Nanotubes (MWCNTs) in Reducing the Corrosion Rate in Cr-MWCNTs Composite Coatings N.M. Dawood, A.M. Nattah and T.A. Jasim  The Influence of Thermo Mechanical Treatment on Corrosion Resistance of Cu-Al-Ni Shape Memory Alloy H.A. Dawood and R.S.A. Adnan  192 Boriding Treatment of Low Alloy Steels: Effect of Holding Time and Temperature Y. Kermiche and Y. Benarioua  Indirect Production of Chromium Carbides Film on Low Alloy Steel Y. Benarioua  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  229 Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali  Morphological and Optical Study of Black P. Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  In Joy/MoSy/Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization	with Waste Glass Materials	172
Cr-MWCNT's Composite Coatings NM. Dawood, A.M. Natiah and T.A. Jasim  The Influence of Thermo Mechanical Treatment on Corrosion Resistance of Cu-Al-Ni Shape Memory Alloy H.A. Dawood and R.S.A. Adnan  192  Boriding Treatment of Low Alloy Steels: Effect of Holding Time and Temperature Y. Kermiche and Y. Benarioua  207  Indirect Production of Chromium Carbides Film on Low Alloy Steel Y. Benarioua  208  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  217  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  247  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali Morphological and Optical Study of Black P-Silicon Textured in KOH Bath Lim. Brahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah In-O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar Lapbaria and H.A. Lafta Conductivity Modification of Zno NRs Films via Gold Coating for T		1/3
Shape Memory Alloy H.A. Dawood and R.S.A. Adnan 192 Boriding Treatment of Low Alloy Steels: Effect of Holding Time and Temperature Y. Kermiche and Y. Benarioua 193 Indirect Production of Chromium Carbides Film on Low Alloy Steel Y. Benarioua 207 Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood 217 Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim 229 Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein 247 Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents L. Al-Sharuce and B.R. Ali Morphological and Optical Study of Black P. Silicon Textured in KOH Bath L.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah 1020/MoS/Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim 275 Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar 294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor	Cr-MWCNTs Composite Coatings	183
H.A. Dawood and R. S.A. Adnan  Boriding Treatment of Low Alloy Steels: Effect of Holding Time and Temperature Y. Kermiche and Y. Benarioua  Indirect Production of Chromium Carbides Film on Low Alloy Steel Y. Benarioua  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuce and B.R. Ali  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  Dielectric, A.C Conductivity and Optical Characterizations of (PVA-PEG) Doped Sro Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	The Influence of Thermo Mechanical Treatment on Corrosion Resistance of Cu-Al-Ni	
Indirect Production of Chromium Carbides Film on Low Alloy Steel Y. Benarioua  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuce and B.R. Ali  1259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah 1260  1275  1275  1275  1275  1275  1275  1275  1276  1276  1276  1276  1276  1277  1276  1277  1276  1277  1277  1277  1278  1279  1279  1270  1270  1271  1271  1272  1275  1275  1275  1275  1275  1275  1275  1275  1275  1275  1275  1275  1276  1276  1276  1276  1276  1277  1276  1277  1277  1277  1278  1277  1278  1279  1279  1270  1270  1271  1271  1272  1275  12	Shape Memory Alloy H.A. Dawood and R.S.A. Adnan	192
Y. Benarioua  Characterization of Functional Polyphenylsilsesquioxane (PhSiO <sub>3/2</sub> ) Hybrid Glass Reinforced with MWCNTs  K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  V. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  Dielectric, AC Conductivity and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		199
Reinforced with MWCNTs K. Al-Marzoki, N.Z. Whieb and F.J. Hmood  Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim  229 Optimization of CO: Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  237 Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  247 Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuce and B.R. Ali Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266 In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275 Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		207
Chapter 4: Laser Processing Technologies  One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim 229 Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan 237 Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein 247 Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuce and B.R. Ali Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah 1266 In-Q-J/MoS-J/Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim 275 Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim 284 Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar 294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Reinforced with MWCNTs	
One-Step Fabricate of Copper Nanoparticles via Pulsed Laser Ablation in Liquid: Influence of Energies on Physical Characterization S.N. Rashid, T.Y. Sabri, S.A. Mahdi and A.S. Jasim 229 Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan 237 Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein 247 Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuce and B.R. Ali 259 Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah 266 In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim 275 Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim 284 Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar 294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta 304 Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	K. Al-Marzoki, N.Z. Whieb and F.J. Hmood	217
of Energies on Physical Characterization S.N. Rashid, T.Y. Šabri, S.A. Mahdi and A.S. Jasim Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan 237 Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein 247 Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali 259 Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah 266 In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim 284 Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar 294 Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta 304 Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Chapter 4: Laser Processing Technologies	
S.N. Rashid, T.Y. Šabri, S.A. Mahdi and A.S. Jasim  Optimization of CO <sub>2</sub> Laser Parameters for Hole Micro Drilling of PMMA: An Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  237  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  247  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		
Experimental and Theoretical Study A.E. Abdulwahab, K.A. Hubeatir and K.I. Imhan  237  Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  247  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali  259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zine Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		229
Multiple-Response Optimization of Aluminum Oxide Nanocoating Prepared by Pulsed Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  247  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali  259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Experimental and Theoretical Study	
Laser Deposition Using Taguchi Design A.M. Hassan, A.A. Alwahib and A.K. Hussein  Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents I. Al-Sharuee and B.R. Ali  259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		237
Chapter 5: Materials for Optoelectronics, Electronics and Energy Storage  Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents  I. Al-Sharuee and B.R. Ali  259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath  I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors  W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO Hybrid Nanocomposites  S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Laffa  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Laser Deposition Using Taguchi Design	247
Absorption Spectrum and Raman Spectroscopy of Coumarin507 Dye Laser in Different Solvents  I. Al-Sharuee and B.R. Ali  259  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors  W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures  E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites  S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma  K. Alzamili and H.A. Lafta  304  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application	A.M. Hassan, A.A. Alwanio and A.K. Husseni	247
Solvents I. Al-Sharuee and B.R. Ali Z59  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah Z66  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim Z75  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim Z84  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar Z94  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	1	
I. Al-Sharuee and B.R. Ali  Morphological and Optical Study of Black P- Silicon Textured in KOH Bath I.M. Ibrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  266  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors  W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites  S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application		
I.M. İbrahim, Z.M. Noori, H.M. Hwail and M.M. Abdullah  In <sub>2</sub> O <sub>3</sub> /MoS <sub>2</sub> /Reduced Graphene Oxide Nanostructure as Composite Electrodes for Supercapacitors  W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application		259
Supercapacitors W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  304  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application		266
W. Ong, H.M. Yen, P.L. Kiew, T.H. Lim, K.L. Leong, S.Y. Tan and J.X. Lim  275  Structural Morphological and Optical Investigations of Nano Silver Oxides Nanostructures E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  304  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application		
E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda and U. Hashim  284  Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO  Hybrid Nanocomposites  S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  294  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma  K. Alzamili and H.A. Lafta  304  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application		275
Hybrid Nanocomposites S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application  Application	E.T. Salim, F.G. Khalid, F.H. Alsultany, A.A.D. Faisal, W.K. Khalef, O.S. Dahham, M.N.A. Uda	284
S.A. Jabbar, S.M. Khalil, A.R. Abdulridha, E. Al-Bermany and A. Karar  Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Dielectric, AC Conductivity and Optical Characterizations of (PVA-PEG) Doped SrO	
K. Alzamili and H.A. Lafta  Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor  Application		294
Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor Application	Characterization of Zinc Oxide Semiconductor Thin Film Treated with Cold Plasma	304
Application	Conductivity Modification of ZnO NRs Films via Gold Coating for Temperature Sensor	
	Application	315

# **Chapter 6: Materials for Biomedical Application**

The Biomedical Investigation of Bioceramic Cordierite as Orthopedic Material M.H. Basheet, F.K. Farhan, A.N. Abed and O.R. Alobaidi	327
Surface Enhancement of Magnesium Implants for Long Term Applications A. Al-Janabi, F.J. Alhasani and E.S. Al Hassani	336
Comparing the Mechanical Behavior of Lamination Resin Reinforced with Two Types of Organic and Inorganic Particles Used in Prosthetic Applications H.A. Sallal and A.S. Kadhim	345
A Review of some Characteristics of a Composite Hybrid Socket for Prosthetics Derived from Plant Fibers  A.M. Bash, J.K. Oleiwi and T.T. Othman	355
Mechanical Properties of Hybrid Composites PMMA Denture Base with Varying Concentrations of Nano-ZrO <sub>2</sub> and Glass Fiber A.F. Mohammed, A.M.N. Almohaisen and K.S. Hassan	363
<b>Deposition of Layered Bioceramic HA/TiO</b> <sub>2</sub> Coatings on Ti-6Al-7Nb Alloys Using Micro-Arc Oxidation Q.K. Naji, J.M. Salman and N.M. Dawood	374
Preparation of Bio-Composite Coatings on Titanium Substrate by Electrostatic Spray Deposition S. Bashar, H.A. Al-Kaisy and M.N. Al-Shroofy	384
Antireflective and Hard Multicoat Design for Allyl Diglycol Carbonate Plastic Spectacle Lenses	301
S.M. Lafta, A.M. Naji and N.J. Mohammed  Boosted Antimicrobial and Self-Cleaning Activities with MnO <sub>2</sub> / ZnO Coated on Cotton	394
Fabric S.M. Lam, C.L. Lim, J.C. Sin and H.H. Zeng	402
Preparation and Characterization of an Electrospun Polycaprolactone/Polyurethane Scaffold for Soft Tissue Applications M.A. Najim, A.R. Jabur, A.M. Al-Shammari, E.S. Al Hassani, W.A.H. Al Nasir and K. Raad	409
Mechanochemical Synthesis of Dendrimers as Nanocarriers: A Review M. Alrbaihat	422
Chapter 7: Technologies of Chemical Production	
Novel Study of Surface Morphological Properties of Commercial Catalytic Reforming Catalysts Used in Iraqi Refineries by Atomic Force Microscopy (AFM)  I.M.A. Shakir and Z.F. Falah	435
Crystallization by Acid Hydrolysis-Sulfonation of Cellulose Nanofibers from Eichhornia crassipes	433
M.A. Siega, H.M. Barra and Y. Manalundong II	446
Chapter 8: Environmental Protection and Bio-Based Building Materials	
Computational and Experimental Simulation of Pollutant Transport through Multiple Porous Media	
N.F. Alnsrawy and S.S. Muhsun  Preparation of Mixed Matrix Membranes Containing COF Materials for CO <sub>2</sub> Removal	455
from Natural Gas/Review A.A. Abdulabbas, T. J. Mohammed and T. A. Al-Hattab	464
Construction of Magnetic Z-Scheme P-Doped Biobr/CoFe $_2$ O $_4$ Nanocomposite for Expeditious Visible Light Photocatalytic Palm Oil Mill Effluent Degradation via the Assistance of IO $_4$ <sup>-</sup> and S $_2$ O $_8$ <sup>2-</sup>	
J.C. Sin, S.M. Lam and H.H. Zeng	476
A Review on Self-Healing Concrete D.K. Jaf and P.I. Abdulrahman	483