

Table of Contents

Preface

Role of Residual Stress in Engineering Applications

G.A. Webster 1

Towards Reference Samples for X-Ray Residual Stress Analysis

R. Botzon and M. François 12

Determination of Alignment Errors in Classical XRD Residual Stress Methods

A.C. Vermeulen and E. Houtman 17

Observations on two Commonly Used Profile Shape Functions

B. Courant, B. Bourniquel, M. François and M. Bessière 23

Construction of the New Material Science Neutron Diffractometer STRESS-SPEC

H.M. Mayer, A. Pyzalla and W. Reimers 29

A Comparison of Neutron and High Energy Synchrotron Radiation as Tools for Texture and Stress Analysis

A. Pyzalla, W. Reimers and K.D. Liss 34

Stress in Thin Layers; Grain Interaction, Elastic Constants and Diffraction Response

J. Kamminga, M. Leoni, U. Welzel, P. Lamparter and E.J. Mittemeijer 42

Determination of Zircaloy -4 Radiocrystallographic Elastic Constants from Room Temperature to 300°C

L. Gosmain, C. Valot, M. Lallemand, D. Ciosmak and O. Sicardy 48

Intergranular Strains in Textured Steel

M.R. Daymond, C. Tomé and M.A.M. Bourke 54

Experimental and Numerical Approach of Inter- and Transgranular Stress- and Rotation Heterogeneities in the Plastic Behaviour of a Multicrystal

F. Eberle, T. Wroblewski, G. Cailletaud and J.L. Lebrun 60

Stress-Orientation Distribution Function (SODF) - Description, Symmetry and Determination

Y.D. Wang, R.L. Peng, X.H. Zeng and R. McGreevy 66

Hybrid Experimental/Numerical Technique for Determination of Residual Stresses in Inhomogeneous Cylinders

J. Valgur and J. Kõo 74

A New Approach to Evaluate Steep Stress Gradients Principally Using Layer Removal

V. Hauk and B. Krüger 80

Determination of Residual Stress Gradients in Brittle Materials Using an Improved Spline Algorithm

H.K. Tönshoff, J. Plöger and H. Seegers 83

Layer Growing/Removing Method for the Determination of Residual Stresses in Thin Inhomogeneous Discs

J. Kõo and J. Valgur 89

A High Energy Microscope for Local Strain Measurements Within Bulk Materials

U. Lienert, H.F. Poulsen, R.V. Martins and Å. Kvik 95

Micro-Area Residual Stress Measurement Using a Two-Dimensional Detector

B.B. He, K.L. Smith, U. Preckwinkel and W. schultz 101

Neutron Strain Scanning at Interfaces: An Optimised Beam Optics to Reduce the Surface Effect

T. Pirling 107

Strain Scanning Using a Neutron Guide Based Diffractometer

P. Mikula and V. Wagner 113

Analysis for Determining Non-Axisymmetric Residual Stresses

A.A. García-Granada, D.J. Smith and M.J. Pavier 119

Experimental Measurements of Non-Axisymmetric Residual Stresses

V. Lacarac, A.A. García-Granada, D.J. Smith and M.J. Pavier 125

Plastic Deformation during Application of the Hole-Drilling Method

J. Gibmeier, M. Kornmeier and B. Scholtes 131

Comparative Analysis of Shot-Peening Residual Stresses Using Hole-Drilling and X-Ray Diffraction Methods	
J.P. Nobre, M. Kornmeier, A.M. Dias and B. Scholtes	138
Genetic Algorithms for Variable Through Thickness Residual Stress Evaluation	
M. Beghini, L. Bertini and W. Rosellini	144
Residual Stress Measurement in Cracked Components: Capabilities and Limitations of the Cut Compliance Method	
H.J. Schindler	150
In Situ Measurement of Stress during Deposition of Boron Nitride Films	
W. Fukarek, C. Fitz, A. Kolitsch and W. Möller	156
X-Ray Stress Tensor Analysis in a Notch with 2 Circles Omega Goniometer	
E. Girard, M. François, R. Guillén and A. Perronnet	161
Gage R&R Study on Residual Stress Measurement System with Area Detector	
B.B. He, K.L. Smith, U. Preckwinkel and W. schultz	166
Residual Stress Measurements with Barkhausen Noise Method in Pipelines and Gas-Turbine Details	
S.F. Minatsevich, S.N. Zvonov, A.V. Ermolaev, A.V. Anisimov and E.S. Minatsevich	172
NQR Spectrometry, a New Tool for the Measurement of Residual Stresses?	
W. Kranendonk and S. Sinnema	178
Phase Transformations and Generation of Heat Treatment Residual Stresses in Metallic Alloys	
S. Denis, P. Archambault, E. Gautier, A. Simon and G. Beck	184
Numerical Simulation of the X-Ray Stress Analysis Technique in Polycrystalline Cubic Materials	
H. Wern and C. Funk	199
Effect of Solidification Segregations on Phase Transformation Kinetics and on the Development of Internal Stresses during Cooling of Steels	
J.-. Louin, S. Denis, H. Combeau, G. Lesoult, A. Simon, C. Aliaga and E. Massoni	205
Computer Simulation of Residual Stress Distribution and Microcracking due to Thermal Expansion Anisotropy	
A. Zimmermann, E.R. Fuller and J. Rödel	211
Stress Analysis of Carbon-Fiber Reinforced Polymeric Materials by Means of X-Ray Diffraction from Fillers - Micromechanical Model and Experimental Results	
R. Meske and E. Schnack	217
Residual Stress Measurement and Prediction in a Hardened Steel Ring	
M.B. Prime, V.C. Prantil, P. Rangaswamy and F.P. García	223
Residual Stresses in an Inconel-718-Clad Tungsten Tube Processed by Hot Iso-static Pressing	
R.B. Parker, D.W. Brown and P. Rangaswamy	229
Cold Compression Residual Stress Reduction in Aluminium Alloy 7010	
D.A. Tanner, J.S. Robinson and R.L. Cudd	235
3D Finite Element Models of Shot Peening Processes	
D. Deslaef, E. Rouhaud and S. Rasouli-Yazdi	241
X-Ray Intergranular Stresses Analysis in a Cast Duplex Stainless Steel	
L. Mcirdi, K. Inal, J.L. Lebrun and G. Barbier	247
Evolution of Microstresses in Plastically Deformed Duplex Steel	
A. Baczmanski, C. Braham, A. Lodini and K. Wierzbanski	253
Predicting Residual Stresses due to Solidification in Cast Plastics	
V. Tropsa, A. Ivanković and J.G. Williams	259
Phenomenological and Microscopical Description of Scattering from Distorted Materials	
R. Barabash and P. Klimanek	266
Determination of Macro- and Microstresses in Deformed Materials by Application of the Strain Function Method	
H. Behnken	273
Thermal Residual Strain in Metallic Samples Subjected to Heating-cooling Cycles: Crystallite Size and Residual Stress Contribution to the X-Ray Profile Broadening	
S. Battaglia and F. Mango	279
Anisotropy of Dislocation Distribution and Long-Range Internal Stresses	
G. Mohamed, B. Bacroix and J.L. Lebrun	285

Distribution of Residual Microstresses in Rolled Textured Metal Materials Y. Perlovich, M. Isaenkova, H.J. Bunge and V. Fesenko	291
Single Grain Analysis of Dislocation Density in Cold Rolled IF-Ti Steel with a New High-Resolution Microdiffraction Technique O. Castelnau, T. Chauveau, M. Drakopoulos, A.A. Snigirev, I. Snigireva, C. Schroer and T. Ungár	297
Advanced Fundamental Parameters Model for Improved Profile Analysis J. Bergmann, R. Kleeberg, A. Haase and B. Breidenstein	303
Microstructure of Polycrystalline Natural Samples from the Peak Profile Analysis of Diffraction Data G. Berti	309
A Comparison of Residual Stress Measurements in Steels using the X-Ray and the Neutron Diffraction Techniques N.J. Celard, B. Pathiraj, K.M. Nikbin and G.A. Webster	316
Neutron Diffraction Investigation of Low and High Cycle Fatigue Austenite Stainless Steels Y.V. Taran, J. Schreiber, P. Mikula, P. Lukáš, D. Neov and M. Vrána	322
In Situ Stress Measurements by Neutron Diffraction in α-γ Fe-Cr-Ni Alloys During Deformation S. Harjo, P. Lukáš, Y. Tomota, D. Neov, M. Vrána, P. Mikula and M. Ono	328
In Situ High-Resolution Neutron Diffraction Study of Stress Induced Martensitic Transformations in CuAlZnMn Shape Memory Alloy D. Neov, P. Šittner, P. Lukáš, V. Novák, P. Strunz, M. Vrána and P. Mikula	334
Neutron and X-Ray Diffraction Analyses of the Influence of Induction-Hardening and Deep-Rolling on the Residual Stresses in Crankshafts H.M. Mayer, C. Achmus, A. Pyzalla and W. Reimers	340
Subsurface Residual Stress Concentrations During Rolling Contact Fatigue A.P. Voskamp	346
Computer Predictions of Thermo-Mechanical Behavior and Residual Stresses during Induction Hardening of Notched Cylinder D.Y. Ju	352
A New Device for In Situ Residual Stress Measurement during Fatigue Testing A.M. Alam, R. Chieragatti and B. Lavelle	358
Creep Induced Evolution of Internal Stresses and Structure in a Singel Crystal Nickel-Base Superalloy U. Brückner, A. Epishin, T. Link and P.D. Portella	363
Residual Stresses in Roller Straightened Rails G. Schleinzner and F.D. Fischer	368
Characterisation of Residual Stress Relaxation in Fatigue Loaded Welded Joints by X-Ray Diffraction and Barkhausen Noise Method C. Lachmann, T. Nitschke-Pagel and H. Wohlfahrt	374
Recent Developments in Mechanical Surface Optimization I. Altenberger and B. Scholtes	382
Residual Stresses in Polycrystalline Thin Films P. Scardi and Y.H. Dong	399
Stress and Diffusion in Nb-W Bilayers U. Welzel, P. Lamparter, M. Leoni and E.J. Mittemeijer	405
X-Ray Stress Determination in Diamond Hard Coatings M. Hempel and M. Härting	411
Residual Stress States in Coated Cemented Carbides H.K. Tönshoff, T. Friemuth, J. Plöger and H. Seegers	417
Residual Stress Analysis and Indentation Tests on Graded PVD-Coatings of Ti(C,N) on Cold-Working Steel T. Dümmer, B. Eigenmann and D. Löhe	423
Microstructural Characterization of Laser Hardened Steel Surfaces K. Obergfell, V. Schulze and O. Vöhringer	429
Combining Case Hardening and Shot Peening for Gear Steels: Influence on Residual Stresses C. Peyrac, J. Flavenot and F. Convert	435

Stability of Residual Stresses in Shot Peened and High Pressure Water Peened Stainless Steels at Elevated Temperatures	
P. Krull, T. Nitschke-Pagel and H. Wohlfahrt	441
Residual Stresses in Peened Hiduminium	
P.J. Webster, P.A. Browne and G. Mills	447
Measuring and Analysis of Residual Stresses After Induction Hardening and Grinding	
J. Grum	453
New Experimental Technique for Measuring Deformation of Thin Plates during Laser Surface Remelting	
J. Grum and R. Šturm	459
Residual Stresses in As-Sprayed and Heat Treated TBCs. Measurements and FEM Calculations	
M.F.J. Koolloos and J.M. Houben	465
Studies of Zirconium Alloy Oxide Layers Using Synchrotron Radiation	
J.L. Béchade, R. Dralet, P. Goudeau and P. Yvon	471
Stress in Poly-SiC Films Grown by Low Pressure CVD	
J. Rodríguez-Viejo, E. Hurtós, R. Kressmann and M.T. Clavaguera-Mora	477
Neutron Diffraction Analysis of the Evolution of Phase Stresses during Plastic Straining of Aluminium Matrix Composites Reinforced with a Continuous, Random Planar Network of Fibres	
L. Ryelandt, C. Salmon and F. Delannay	486
The Development of Strain Anisotropy during Plastic Deformation of an Aluminium Polycrystal	
A.M. Korsunsky, M.R. Daymond and K.E. Wells	492
Study of Residual Stress Distribution by the Combination of three Techniques in an Aluminium Based MMC	
D. Retraint and J. Lu	498
A Comparative Study of Diffraction Methods for Strain Measurement in a Particulate MMC	
A.M. Korsunsky, K.E. Wells and B.A. Shaw	504
Study of Phase Stresses in an Al/SiC Metal Matrix Composite	
R. Levy-Tubiana, A. Baczmanski, M. Ceretti, M.E. Fitzpatrick, A. Lodini and K. Wierzbowski	510
Dynamic Response of Residual Stresses due to Rapid Temperature Changes in Kaowool Reinforced AA339 Aluminum	
G. Langelaan, S. Saimoto and W.J. Baxter	516
Residual Stresses in Interface Controlled Materials by Neutron Diffraction *	
A. Youtsos and C. Ohms	524
Strain Measurement of a Ductile Composite $\text{Al}_2\text{O}_3/\text{Y}_3\text{Al}_5\text{O}_{12}$ (YAG) by Neutron Diffraction	
M. Ono, Y. Waku, M. Vrána, P. Mikula, A. Mitani, K. Shimizu and T. Fukunaga	530
Modelisation of Strains Measured by X-Ray Diffraction in Composites with Spherical Particles	
L. Durand, B. Lavelle, R. Drira-Halouani and A. Altibelli	536
Strain Measurements on Geomaterials by Neutron Time-of-Flight Diffraction	
C. Scheffzük, K. Walther and A. Frischbutter	542
Prediction of Macro- and Microstresses in Supersaturated Alloy Layers Before and After Precipitation Treatments	
L. Velterop, R. Delhez and E.J. Mittemeijer	548
Internal Stresses in Aluminium Interconnects	
A. Saerens, P. van Houtte and A. Witvrouw	556
X-Ray Diffraction Determination of Residual Stresses in Narrow Copper Interconnects with Submicronic Widths	
O. Sicardy, I. Touet, L. Arnaud, F. Charlet and T. Berger	562
Characterization of the Interface Strain/Stress State in Si-on-Sapphire Heterostructure	
D. Mogilyanski, E. Gartstein and H. Metzger	568
Curvature Behaviour of Multilayer Specimens of Thermal Barrier Systems	
G. Blandin, S.E. Brünings, R.W. Steinbrech and L. Singheiser	574
Characterisation of Residual Stress and Microstructure in Bioactive Coatings for Titanium Alloy Hip Implants	
M. Härting and M. Hempel	580

Measured Stress Concentration at a Notch Front in Si₃N₄ S.I. Tanaka	586
Residual Stresses due to Hard-Machining - Industrial Experiences P. Vomacka and H. Walburger	592
Neutron Diffraction Measurement of Residual Stresses in AA6082 Quenched Samples G. Albertini, G. Caglioti, F. Fiori, T. Pirling, V. Stanic and J.S. Wright	598
Micro- and Macrostress Evolution in a Duplex Stainless Steel during Uniaxial Loading J. Johansson and M. Odén	603
Stress State Prediction Applied to Local Composition Changes R.J.C. Silva and F.M. Braz Fernandes	609
Simulation of Stress and Residual Stresses due to Gas Quenching of AISI 52100 Steel Cylinders R. Kübler, H. Müller and D. Löhe	615
Influence of Various Quenching Agents on Residual Stresses in Steel After Heat Treatment J. Grum, S. Božič and M. Zupančič	621
The Influence of Residual Stresses in a Welded Vessel on the Hydrogen Attack Lifetime S.M. Schlögl and E. Van der Giessen	628
The Influence of Residual Stresses on the Mechanical Behaviour of ZrO₂/Ni/AISI 316 Diffusion Bonds R.H. Vegter and G. den Ouden	634
The Time-of-Flight Neutron Diffraction Measurements of Residual Stresses in a Shape Welded Steel Tube Y.V. Taran, J. Schreiber and J.S. Wright	640
Evaluation of Through Wall Residual Stresses in Stainless Steel Weld Repairs D. George, D.J. Smith and P.J. Bouchard	646
Residual Stresses in Brazed Joints of Cemented Carbide and Steel with Complex Geometry L. Pintschovius, B. Schreieck, B. Eigenmann and D. Löhe	652
Residual Stress Measurements in Thick Structural Weldments by Means of Neutron Diffraction* C. Ohms, A. Youtsos, P. v.d. Idsert and T. Timke	658
Measurement of Residual Stresses in a Multi-Pass Low Alloy Ferritic Steel Weld Using X-Ray Diffraction E.J. McDonald, L.F. Exworthy, P.E.J. Flewitt, K. Hallam and W. Bell	664
Evaluation of Residual Stresses Near a Welded Zone by Transmission Energy Dispersive X-Ray Diffraction B. Lavelle and J. Jaud	670
Residual Stresses in an AA6082 Shrink-Fit Thermoplastic Junction G. Albertini, G. Caglioti, M. Ceretti, F. Fiori, R. Monzani and L. Viviani	674
Residual Stress Field in a Friction Stir Welded Aluminium Extrusion L. Djapic Oosterkamp, P.J. Webster, P.A. Browne, G.B.M. Vaughan and P.J. Withers	678
Neutron Diffraction Measurements for the Determination of Residual Stress in Ti6Al4V Welded Plates G. Bruno, A. Carradò, B. Dunn, F. Fiori, E. Girardin, T. Pirling and F. Rustichelli	684