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Mr. Kenneth E. Bagnoli

Education

B.E., Metallurgy, Stevens Institute of Technology (1986)
M.S., Materials Science, Columbia University (1989)

Relevant Technical Experience

High Temperature Metallurgy

- Experience conducting tests on various materials ranging from low alloy steels, stainless steels/welds, high alloy castings (e.g., 25Cr-20Ni), superalloys, etc.
- Currently leading testing program for ASME-API 579 evaluating creep properties in hydrogen environments
- Developed modified creep constitutive models based on theta projection and omega model for various low alloy steels and stainless weld metal
- Evaluated multiaxial creep behavior of stainless steels to improve high temperature reactor internal component weldments subject to high mechanical constraint
- Used continuum damage mechanics modeling to characterize effects of hydrogen attack on creep and creep crack growth
- Carried out creep crack growth analyses using C_t , C^* models to conduct high temperature flaw assessments
- Evaluated corrosion potential of various alloys using phase stability diagrams using software package HSC Chemistry for sulfidizing and carburizing environments
- Conducted microstructural studies on superalloy turbine blades removed from service to evaluate coating degradation and evolution of gamma prime

Fracture Mechanics

- Experience conducting J integral testing and characterizing resistance curves
- Performed various flaw analyses using FAD or ductile tearing based methods
- Experience using FEACrack/WARP3D to model cracks to evaluate crack driving force (K, J) as well as constraint parameters (T-stress, Q, A_2)
- Used constraint analysis (J- A_2) to modify tearing curves to enhance transferability of test data to structural components
- Evaluated validity criteria of miniature toughness specimens through study of crack tip stress fields
- Led testing program (over 500 tests) to characterize fracture toughness and tearing behavior of pipeline steels/weldments to evaluate flaw stability in electric resistance welded line pipe.

Work History

ExxonMobil Research and Engineering Company, 1990-2022, retired as Distinguished Engineering Associate and Principal Engineer

Relevant Projects

- Led study on sustained combustion of various alloys in oxygen enriched environments at elevated temperatures and diluent contents, conducted at NASA White Sands Test Facility, Las Cruces, NM.
- Led laboratory study on metal dusting attack of alloys in high carbon activity gas systems
- Performed deterministic and probabilistic creep life analyses of low alloy steels used in catalytic reformer furnaces, and high alloy centrifugally cast furnace tubes used in steam-methane reformers producing hydrogen.
- Developed framework for evaluating probability of leak/rupture of vessels and piping subject to corrosion using a Bayesian approach.
- Evaluated creep data conducted by SWRI to develop life prediction for GE alloy GTD-111DS using an iso-strain approach
- Studied effects of multiaxial stress on creep ductility of stainless steels using various blunt double-notched specimens
- Developed procedures for assessing minimum pressurization temperature for heavy wall pressure vessels in hydrogen service.
- Led Pipeline Fitness for Service Study Team
 - Developed revised FFS procedures for seam integrity of vintage pipelines.
 - Development of new SEN(T) specimen geometry for evaluating pipeline seam welds.
 - Implemented probabilistic methods for predicting fatigue crack growth life
 - Conducted major testing program (over 500 tests) to characterize fracture toughness of vintage pipeline seam welds.
- Performed study on constraint adjustment of J-R curves using A_2 parameter.
- Led study evaluating the validity of using miniature compact test specimens (mini-CT) on the upper shelf using finite element analysis (FEACrack/WARP3D)
- Performed fracture toughness testing of steels in high temperature hydrogen to characterize tearing resistance for input to flaw assessment
- Led study of fracture toughness and sub-critical crack growth of steels in simulated refinery sour water (H_2S) streams
- Currently leading ASME-API 579 task group on creep testing of steels in hydrogen service to evaluate various life assessment approaches

Professional Affiliations

American Petroleum Institute (API)

- Past member and former chair of Committee on Refining Equipment
- Sponsor for ASME-API 579 committee
- Co-chair of API 1176 on pipeline seam integrity

ASME-API 579

- Voting member since 2011

Publications

J.K. Tien, K.E. Bagnoli, M.W. Kopp, *Investigation of Diffusion Induced Recrystallization of Doped Tungsten Fibers in Tungsten Fiber Reinforced Superalloy Composites*, International Conference on Recrystallization in Metallic Materials, TMS publication, 1990, edited by T. Chandra.

R. Yazici, K.E. Bagnoli, Y. Bae, *Determination of Thermally and Mechanically Induced Residual Stress in Metal Matrix Composites by X-Ray Methods*, Material Research Proceedings, Nondestructive Monitoring of Materials Properties, Vol. 142, editors J. Holbrook, J. Bussiere, 1989.

K.E. Bagnoli, Z.D. Cater-Cyker, B.S. Budiman, *Evaluation of the Theta Projection Technique for Estimating the Remaining Creep Life of GTD-111DS Turbine Blades*, Proc. ASME paper GT2007, Volume 5: Turbo Expo 2007, 181-190, May 14–17, 2007.

K.E. Bagnoli, Z.D. Cater-Cyker, C.A. Hay, R.L. Holloman, Y. Hioe, G. Wilkowski, B.C. Rollins, K.M. Nikbin, *Assessment of Flaws in Non-Stress Relieved Carbon Steel Welds Caused by Hydrogen Attack*, Proc. ASME. PVP2021, Volume 4: Materials and Fabrication, July 13–15, 2021, PVP2021-61603.

B.C. Rollins, O.J. Tarbard, K.E. Bagnoli, R. Thodla, *Fracture Toughness Behavior of Carbon Steels in Mildly Sour Waters*, Proc. ASME. PVP2021, Volume 4: Materials and Fabrication, July 13–15, ASME PVP2021-63030.

K.E. Bagnoli, Z.D. Cater-Cyker, R.L. Holloman, C.A. Hay, S. Chavoshi, K.M. Nikbin, L.T. Hill, *Volumetric Damage Modeling of High Temperature Hydrogen Attack in Steel Using a Continuum Damage Mechanics Approach*, Proc. ASME. PVP2020, Volume 3: Design and Analysis, August 3, 2020, ASME PVP2020-21279.

F.W. Brust, L.T. Hill, G. Wilkowski, Y. Hioe, K.E. Bagnoli, *A Novel Approach to Account for Weld Residual Stresses in Pressure Vessel Flaw Assessments*, Proc. ASME. PVP2019, Volume 6A: Materials and Fabrication, July 14–19, 2019, ASME PVP2019-94022.

M. Uddin, G. Wilkowski, E. Kurth, L. Hill, K. Bagnoli, *Modeling of Cracked Pipe System: Effect of Boundary Conditions on Displacement-Controlled and Load-Controlled Leak-Before-Break*, Proc. ASME PVP2019, Volume 6A: Materials and Fabrication, July 14–19, 2019, PVP2019-93927.

G. Thorwald, K.E. Bagnoli, *Adjusted J-R Toughness Curve for Pipes Using J-A₂ Crack Constraint of CT Specimens and 3D Crack Meshes*, Proc. ASME. PVP2019, Volume 3: Design and Analysis, July 14–19, 2019, PVP2019-93683.

G. Wilkowski, Y. Hioe, E. Kurth, E. Punch, M. Uddin, F.W. Brust, K.E. Bagnoli, G. Pioszak, *Initial Developments for LBB Application to HTHA Sensitive Non-Stress Relieved Carbon Steel Girth Welds in Refinery Plants*, Proc. ASME. PVP2018, Volume 1A: Codes and Standards, July 15–20, 2018, PVP2018-84669.

K.E. Bagnoli, R.L. Holloman, G. Thorwald, Y. Hioe, *Evaluation of Validity Criteria for Subsize Compact tension Specimens Using a Bending Modified J-A₂ Solution*, to be published in Proc. ASME PVP2022, Volume 6A: Materials and Fabrication, July 17–22, 2019, PVP2022-81773.

K.E. Bagnoli, T. Neeraj, G.L. Pioszak, R.L. Holloman, G. Thorwald, C.L. Hay, *Fracture Toughness Evaluation of Pre-1980's Electric Resistance Welded Pipeline Seam Welds*, to be published in Proc. ASME IPC2022, September 26-30, 2022, IPC2022-86014.

S.Z. Chavoshi, L.T. Hill, K.E. Bagnoli, R.L. Holloman, K.M. Nikbin, *A combined fugacity and multi-axial ductility damage approach in predicting high temperature hydrogen attack in a reactor inlet nozzle*, Engineering Failure Analysis, Volume 117, November, 2020 104958.

Jing Ma, K.E. Bagnoli, T. Neeraj, J.W. Krynicki, G. Gonzalez, Z.D. Cater-Cyker, *Advancement of Probabilistic Analysis of Seam Weld Cracking Integrity Management*, to be published in Proc. ASME IPC2022, September 26-30, 2022, IPC2022-86993.

Y. Hioe, F. Orth, G. Wilkowski, J.K. Hong, K.E. Bagnoli, *Initial Experimental and Analytical Efforts to Predict Sustained Crack Growth During a Hydrotest and Subsequent Fatigue Crack Growth During Pressure Cycling*, to be published in Proc. ASME IPC2022, September 26-30, 2022, IPC2022-887354.

B.C. Rollins, R. Thodla, K.E. Bagnoli, Z.D. Cater-Cyker, *Evaluation of the Ductile Tearing Characteristics of Ex-Service ASTM A106 Grade B Carbon Steel in High Temperature Hydrogen*, CORROSION 2019, NACE-2019-13528.

C. Donnelly, K.E. Bagnoli, M. Gustafsson, A. Skoulidas, *Strain Based Modeling of Thermal Mix Points*, CORROSION 2012, NACE-2012-1134.

J.W. Krynicki, K.E. Bagnoli, J.E. McLaughlin, *Probabilistic Risk Based Approach for Performing an Onstream High Temperature Hydrogen Attack Inspection*, CORROSION2006, NACE-2006-06580.

K.E. Bagnoli, V.A. Carucci, *Fire-Damage Assessment Cuts Reconstruction Costs, Plant Downtime*, Oil & Gas Journal, Sept. 18, 2000.