

Dr. Robert E. Hackenberg

roberth@lanl.gov

A Pittsburgh native, Dr. Robert Hackenberg obtained his BS and PhD in Materials Science and Engineering from the University of Pittsburgh (1994) and the University of Virginia (2001). A UVA, he studied pearlite and bainite phase transformations in Fe-C-Mo and other alloy steels using analytical TEM, with an emphasis on interphase boundary carbide precipitation. He joined Los Alamos National Laboratory in 2001 as a postdoc where he studied phase changes in shock-loaded NiTi using TEM. Bob is a R&D Scientist in Sigma Manufacturing Sciences Division, where he studies the physical metallurgy of uranium and other alloys and manages several long-term materials aging and lifetime prediction projects.



Bob served as the TMS Phase Transformations committee chair (2008-10) and has organized 5 symposia. He has peer reviewed over 100 papers for a variety of materials journals. He is a regular attendee at the TMS Annual Meeting, MS&T, and specialty conferences in thermodynamics and physical metallurgy / phase transformations. Bob's experience includes collaborations with the Advanced Steel Processing and Products Research Center (ASPPRC) at the Colorado School of Mines and the National Center for Metallurgical Research (CENIM-CSIC, Madrid), and Texas A&M. He is the author of over 85 publications.

Bob's main research interest is in the thermodynamic and kinetic fundamentals of diffusional phase transformations in a variety of inorganic materials. Problems in microstructural evolution are of perennial interest, including the origins of precipitate morphologies, kinetic competition between stable vs. metastable/non-equilibrium precipitate crystal structures and compositions, and reaction paths/approach to equilibrium. More recently, he has explored the historical roots of materials science, especially through the evolution of phase transformations understanding in steels, 1880-1970. A related interest involves the roles of played in the scientific process by institutions, schools of thought, and academic genealogies.

Bob has a current interest in workflow tools relevant to materials informatics, specifically: analysis and visualization methods that can handle heterogeneous data sets common to materials studies (micrographs, numbers, text), which is especially relevant for structural materials. Such 'friction-reducing' tools in the human-computer interface would enable materials experts to more easily grasp the breadth and depth of microstructure-aware and process-path-critical materials information, resulting in more rigorous critical comparisons between theory and experiment, and improved insight into materials behavior more broadly. Many materials R&D studies fall short of their promise because they only look at one, or at best, a few alloys and overgeneralize the conclusions; by looking at the entire spectrum of data in using informatics tools, more robust insights can be gained that cut through the peculiarities of any one alloy, experimental approach, or R&D lab. Current activities in this area focus on solid-solid precipitation reactions across much of the periodic table.

Selected publications

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- 2003hac2 **R.E. Hackenberg** and G.J. Shiflet, "The Influence of Morphology on Grain-Boundary and Twin-Boundary Bainite Growth Kinetics at the Bay in Fe-C-Mo," *Philosophical Magazine* 83, 3367-3385 (2003). doi.org/10.1080/14786430310001607379
- 2004hut2 C.R. Hutchinson, **R.E. Hackenberg**, and G.J. Shiflet, "The Growth of Partitioned Pearlite in Fe-C-Mn Steels," *Acta Materialia* 52, 3565-3585 (2004). doi.org/10.1016/j.actamat.2004.04.010
- 2005swi D.C. Swift, J.G. Niemczura, D.L. Paisley, R.P. Johnson, A. Hauer, **R.E. Hackenberg**, J.C. Cooley, D.J. Thoma, and G.J. Ackland, "Thermodynamically Complete Equations of State for Nickel-Titanium Alloy," *Journal of Applied Physics* 98, 095312 (2005). doi.org/10.1063/1.2103419
- 2007spe1 J.G. Speer, **R.E. Hackenberg**, B.C. DeCooman, and D.K. Matlock, "Influence of Interface Migration During Annealing of Martensite/Austenite Mixtures " *Philosophical Magazine Letters* 87, 379-382 (2007). doi.org/10.1080/09500830701194173
- 2009cla2 A.J. Clarke, R.D. Field, **R.E. Hackenberg**, D.J. Thoma, D.W. Brown, D.F. Teter, M.K. Miller, K.F. Russell, D.V. Edmonds, and G. Beverini, "Low Temperature Age-Hardening in U-13 At.%Nb: An Assessment of Chemical Redistribution Mechanisms," *Journal of Nuclear Materials* 393, 282-291 (2009). doi.org/10.1016/j.jnucmat.2009.06.025

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- 2012hac1 **R.E. Hackenberg**, "The Historical Development of Phase Transformations Understanding in Ferrous Alloys," in "Phase Transformations in Steels, Volume 1," E. Pereloma and D.V. Edmonds, ed. (Woodhead Publishing, Cambridge, 2012), pp. 3-55. This has also been issued (and is citable) as: Los Alamos National Laboratory Report LA-UR-12-01228 (Los Alamos, NM, 2012). available upon request. doi.org/10.1533/9780857096104.1.3
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