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The Materials Genome Initiative and the "Data Revolution"

As announced in 2011, the goal of the Materials Genome Initiative is to reduce the time and cost of material development and deployment by fifty percent. To reach this goal, a materials data infrastructure is evolving that includes the integration of a variety of workflow and data curation tools, repositories and registries. Central to this data infrastructure and the materials design process are phase-based property data (e.g. phase transformation temperatures, diffusivities, molar volumes, elastic coefficients and thermal expansion coefficients). These data sets are diverse in type, semi-structured, and often missing essential metadata and thus, present significant challenges to curate, share and transform. NIST is developing a variety of tools to address these challenges, including a materials-based digital repository and a web-based curation tool, the Materials Data Curator (MDC). The NIST digital materials repository is a customized version of the DSpace software, an open-source digital repository software that enables users to curate and share a wide variety of digital content including text, images and video. The web-based MDC allows users to store data in a non-relational database, use semantic-based technologies and integrate with a variety of workflow tools. The curation of a set of experimental diffusion data and a set of simulation data using the MDC will be demonstrated. Successful implementation of these and other data curation tools and repositories will enable more efficient materials design methods and new opportunities to integrate data science tools with materials science.

Biography: Carelyn Campbell is the leader of the Thermodynamics and Kinetics group in the Materials Science and Engineering Division in the Material Measurement Laboratory at the National Institute of Standards and Technology (NIST). Her research is focused on the development of a materials data infrastructure for phase-based property data and on diffusion in multicomponent multiphase systems. Since 2003, she has sponsored the annual NIST Diffusion Workshop series, which brings together experimentalists and theorists to improve the development of diffusion mobility databases and the prediction of diffusion controlled microstructure evolution in multicomponent multiphase systems. She received both her BS and PhD in Materials Science and Engineering from Northwestern University. She began her tenure at NIST in 1997, as a National Research Council Postdoctoral Fellow. In 2010, she received a Bronze Medal from the Department of Commerce for superior federal service in leading the NIST Diffusion Workshop series.