
30 Years of Imaging and Modeling Building Materials at NBS/NIST: From PIXAR to MICROCHAR

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Abstract

Computer image processing and quantitative image analysis have become mainstays of both the academic and industrial communities during the past 30 years. This presentation will review research conducted at NBS/NIST during this era on polymeric and inorganic materials. In the mid 1980's, NBS developed its first home-built image processing system for the analysis of defects in building materials using both video and infrared cameras. From this initial effort, it was subsequently recognized that digital imaging could be equally applied to computer modeling, with the NBS/NIST cement hydration models being one primary example of this application. Here, computer imaging is critical for providing quantitative phase composition and location information to use as model inputs, while also providing the framework for 2-D and 3-D simulations of microstructure development. These models, initially developed in the late 1980s, continue to be employed worldwide in the present day. More recent research has focused on examining microstructure and water movement in cement-based materials using both X-ray and neutron imaging techniques and the coupling of image analysis/preprocessing with Multiphysics simulations to validate the underlying models and provide real world performance and service life predictions. Throughout this time period, NBS/NIST has also emphasized the distribution of these models and analysis routines to the end-user community. The Visible Cement Data Set will be highlighted as one example of such technology transfer.

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