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Abstract

Improved microstructural imaging and characterization methods have recently opened the door for quantitative evaluation of microstructures of such functional materials as solid oxide fuel cell and battery electrodes and composite gas separation membranes. Accurate quantitative characterization of these structures relies on the concept of a representative volume element (RVE) to provide a sufficiently large sample to be statistically representative of the material. In Part 1 of this work, several models were described to determine the RVE size for several common microstructural properties: volume fraction, particle size, and network contiguity. In this work, extensive synchrotron x-ray nanotomography imaging of a multiphase composite gas separation membrane is used to provide an experimental comparison to the model predictions. Results suggest that the models provide a reasonable estimate of RVE size, and can serve as a starting point for researchers planning imaging and characterization experiments.

1. Introduction to Experimental RVEs

Numerous experimental studies have aimed to quantify an RVE size for material characterization. Frequently, the evaluation of volume-independence is performed after imaging either by altering the analysis volume or splitting the total sample volume into numerous smaller