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“Mechanical Properties of Porous Wall Hollow Glass Microspheres”

Abstract

Porous Wall Hollow Glass Microspheres (PWHGMs) are a relatively new development in the area of microspheres. The unique property of PWHGMs is the porosity found in their walls. This porosity allows various materials to be encapsulated in the hollow interior. This feature makes PWHGMs useful for a wide range of applications in filtration and encapsulation such as drug delivery. PWHGMs are made by heat treating a microsphere made of alkali borosilicate glass to cause phase separation of the glass into sodium borate and silica. The HGMs are then placed in acid to leach the sodium borate away leaving a porous silica microsphere behind.

Until now there has been no research examining the mechanical properties of this unique microsphere. In this study, the crush strength of the microspheres were experimentally determined by crushing individual microspheres between two plates using nanoindentation. Individual microspheres placed on a fused silica slide were identified using microscopy and crushed using a diamond flat end tip. The crush strength was then used to examine the probability of failure of the microspheres as a series and at different diameter ranges using the Weibull analysis. Four types of microspheres were tested: 3M S38HS HGMs, ARC HGMs without heat treatment or leaching, heat treated ARC HGMs without leaching, and PWHGMs.

Biosketch

Ben Dillinger is a graduate student working on his Master’s degree in materials Science and Engineering with the help of his adviser Dr. David Clark. He received his B.S. from the Materials Science and Engineering Department of Virginia Tech in the fall of 2013. His research is on the crush strength of Porous Wall Hollow Glass Microspheres.