HARVEY MUDD COLLEGE

Engineering Seminar Program
Wednesday, March 9, 2011
Galileo McAlister 4:15 p.m.

Thomas Martens, Ph.D.

Thomas Martens is a PhD candidate in Automotive Engineering at the Clemson University International Center for Automotive Research (CU-ICAR) in Greenville, SC. He received his BS (Dipl.Ing. (FH)) in Mechanical Engineering from Fachhochschule Wilhelmshaven in Wilhelmshaven, Germany, in 1993. After graduating, Thomas worked in several positions in industry, mainly in manufacturing. He also had his own metal injection molding company. In 2008, Thomas resumed his education at the CU-ICAR. He worked under the guidance of Dr. Laine Mears on projects with Michelin (manufacturing of a non-pneumatic tire) and Hoowaki (micro feature molds). His PhD research is on micro feature enhanced sinter bonding of metal injection molded parts to solid substrates. His further research interests are in rapid prototyping/tooling and net shape manufacturing.

Micro feature enhanced sinter bonding of metal injection molded (MIM) parts to solid substrate.

In metal injection molding, fine metal powders are mixed with a binder and injected into molds, similar to plastic injection molding. After molding, the binder is removed from the part, and the compact is sintered to near full density. The MIM process has certain size and shape constraints that could be overcome by joining the MIM compact to a solid part. The obstacle to sinter bonding a MIM part to a conventional (solid) substrate lies in the sinter shrinkage of the MIM part which can be up to 20%, meaning that the MIM part shrinks during sintering, while the conventional substrate maintains its dimensions. This behavior would typically inhibit bonding and/or cause cracking and deformation of the MIM part. A structure of micro features molded onto the surface of the MIM part allows for shrinkage while bonding to the substrate. The micro features tolerate certain plastic deformation to permit the shrinkage without causing cracks after the initial bonds are established. In a first series of tests, bond strengths of up to 80% of that of resistance welds have been achieved.