Surface roughness reduction using spray-coated hydrogen silsesquioxane reflow - DTU Orbit (11/03/2019)

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Surface roughness or texture is the most visible property of any object, including injection molded plastic parts. Roughness of the injection molding (IM) tool cavity directly affects not only appearance and perception of quality, but often also the function of all manufactured plastic parts. So called “optically smooth” plastic surfaces is one example, where low roughness of a tool cavity is desirable. Such tool surfaces can be very expensive to fabricate using conventional means, such as abrasive diamond polishing or diamond turning. We present a novel process to coat machined metal parts with hydrogen silsesquioxane (HSQ) to reduce their surface roughness. Results from the testing of surfaces made from two starting roughnesses are presented; one polished with grit 2500 sandpaper, another with grit 11,000 diamond polishing paste. We characterize the two surfaces with AFM, SEM and optical profilometry before and after coating. We show that the HSQ coating is able to reduce peak-to-valley roughness more than 20 times on the sandpaper polished sample, from 2.44(±0.99)μm to 104(±22)nm and more than 10 times for the paste polished sample from 1.85(±0.63)μm to 162(±28)nm while roughness averages are reduced 10 and 3 times respectively. We completed more than 10,000 injection molding cycles without detectable degradation of the HSQ coating. This result opens new possibilities for molding of affordable plastic parts with perfect surface finish.

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