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Tribological performance of polymethyl methacrylate as an aviation polymer

Abstract: Polymethyl methacrylate (PMMA) is one of the most popular synthetic polymers in aircraft windshields as an alternative to glass, due to its lightweight, high transparency and impact-resistant characteristics. The erosion behavior of PMMA is critical when used as an alternative to glass in an aircraft windshield. This paper presents experimental data on the effects of particle size, velocity and impingement angle on the roughness of PMMA, using 3D optical profilometry after solid particle erosion tests. Particular attention is paid to determining the different morphologies of imprints and cracks with regard to particle size, impact velocity and impingement angle. It is further shown that the removed volume in overlapping impacts measured by 3D profilometry is captured well. It is demonstrated that maximum erosion rate occurred at a 30° impingement angle and correlates well with the ductile erosion behavior of PMMA. Detailed worn surface analysis was performed using 3D optical profilometer scanning to investigate effects of particle size, velocity and impingement angle on the roughness of PMMA.

Keywords: 3D optical profilometer; polymethyl methacrylate; roughness; SEM; solid particle erosion.

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