Chemical Resistance

Gentoo was also assessed for fluid resistance when applied over MIL-PRF-23377 epoxy primer with MIL-PRF-85285D grey urethane topcoat painted, LHE Zn-Ni plated 4130 steel panels according to MIL-PRF-85285D fluid immersion testing and the High-strength Steel Joint Test Protocol. For MIL-PRF-85285D fluid immersion testing, coated panels are cured, stored in a desiccator for at least 16 h, and weighed prior to immersion in the following solvents for 7 days at 37.8°C: Aircraft Deicing/Anti-icing fluid (SAE AMS 1424), Cleaning Compound (Degreaser), Aerospace Equipment (MIL-PRF-87937) and Paint Remover, PR-3500 epoxy paint remover.

Table 3
MIL-PRF-85285D Fluid Immersion Test Fluids and Conditions

Immersion Fluid	Fluid temperature	Time of immersion
Lubricating oil (conforming to MIL-L-23699)	121 ±3 °C (250 ±5 °F)	24 hours
Hydraulic fluid (conforming to MIL-PRF-83282)	66 ±3 °C (150 ±5 °F)	24 hours
JP-8 fuel (conforming to MIL-DTL-5624)	Room temperature	7 days

Gentoo demonstrated no blistering or coating defects and maintained hydrophobic performance following immersion in aircraft deicing fluid, cleaning compound (degreaser), lubricating oil, hydraulic fluid and JP-8 fuel. The Gentoo was removed using the PR-3500 epoxy paint remover, as expected. Commercially available superhydrophobic (SHP) paint was also assessed, and that coating lost all superhydrophobic and hydrophobic performance after immersion in all fluids, and was completely removed when immersed in most fluids, except deicing fluids. Figure 1 exhibits some representative images.

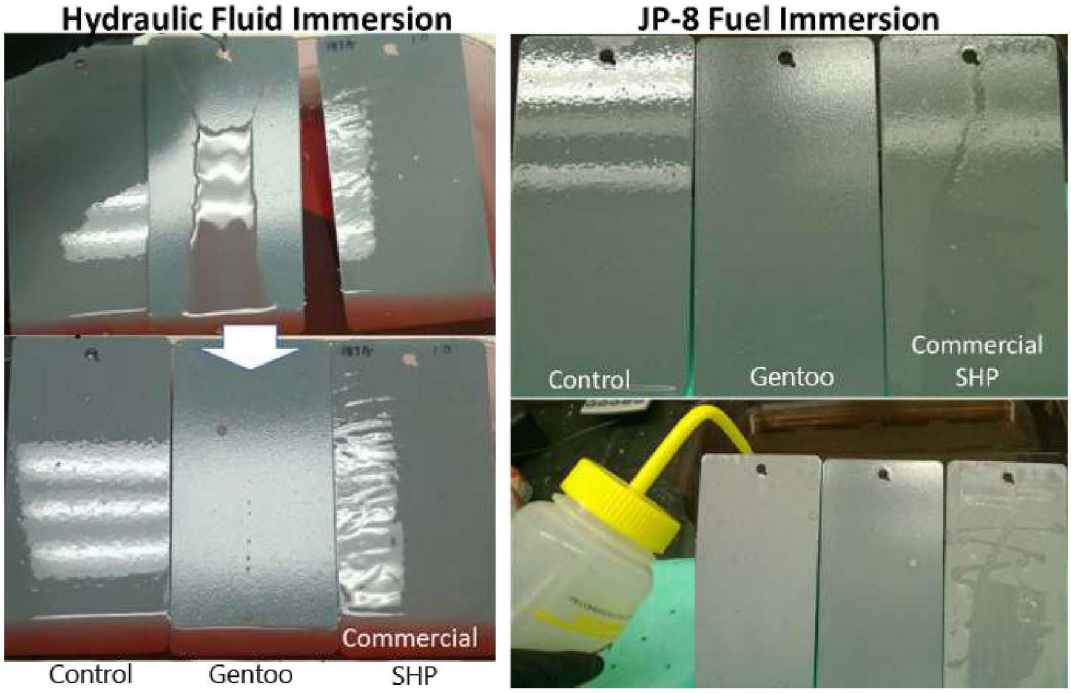

Figure 1

Fluid Immersion assessment of MIL-PRF-23377 Primer with MIL-PRF-85285D Topcoat painted aluminum panels untreated (control), Gentoo-treated, and commercial SHP treated in Hydraulic fluid at 66°C for 24 hours(Left) and JP-8 at room temperature for 7 days followed by an isopropanol rinse (Right)

Flexibility

Initial flexibility assessment is performed using a mandrel bend test where coated metal coupons are bent around mandrels ranging in diameter from 1/8 to 1 inch and assessed for cracking or delamination from the substrate according to ASTM D522. Bend Adhesion testing as specified in MIL-PRF-85285 to evaluate cold temperature flexibility of the Gentoo at -51°C is also performed.

Gentoo exhibits excellent flexibility at room and low temperatures (Figure 2). Gentoo at -51°C bent over a ¾ inch mandrel cracked during low temperature flexibility assessment, but failure of the primer – aluminum panel interface resulted in complete coating failure. The Gentoo was not the source of the failure and the ragged edges are indicative of the Gentoo attempting to keep the coating system together despite the delamination event. An aluminum panel coated only with Gentoo was reevaluated at -51°C and passed ½ inch mandrel bend. Hydrophobic performance of the Gentoo retained as evident by the water drop on the tested surface.

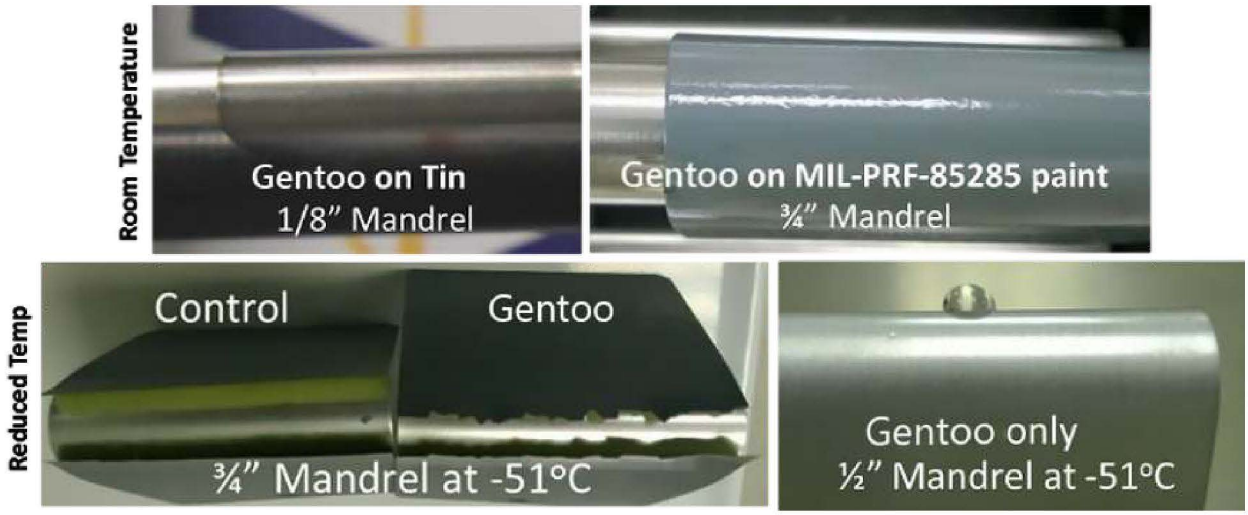

Figure 2

Mandrel Bend Flexibility of Gentoo Treatment at Room Temperature direct to metal and on MIL-PRF-85285 grey urethane topcoat (Top Row) and -51°C on MIL-PRF-85285 grey urethane topcoat (Bottom Row)

Gentoo is stable up to 200°C according to Figure 3 TGA decomposition curve. Thus, the coting has a wide range of operating temperatures from -51 to 200°C.; however, for continuous use (as opposed to temperature spikes) we recommend a maximum operating temperature of 160°C

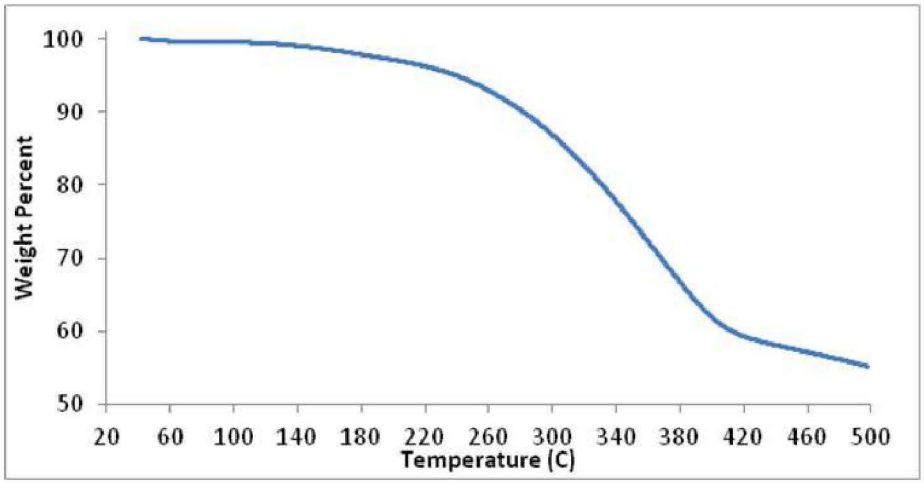

Figure 3

Decomposition TGA of cured, Gentoo formulation (ramp rate of 3°C/minutes)