HDPE vs Precidium™ ECS Comparison Testing

The purpose of this test was to compare the ability of Precidium™ ECS polyurea and HDPE to recover from being stretched under load or impacted by having a heavy weight dropped on it.

Tensile Strength at Maximum Load

Samples of High Density Polyethylene (HDPE) and Precidium™ ECS were made and tested as per ASTM D412 (Die C) using an Instron Universal Testing Machine. This test demonstrates that in samples that have not been stretched or impacted in any way, Precidium™ ECS and HDPE have similar tensile strengths.

Tensile/Elongation After Stress

Samples of both materials were stretched to 200% elongation using the Instron. They were then allowed to recover for an hour (as seen in Figure 1) and the thickness of the stressed areas was measured. This test showed that Precidium™ ECS almost returns to its original thickness after being stretched under load, while HDPE does not recover and is stretched permanently to a thinner cross section, HDPE has a yield point of approximately 12.5% elongation; if it is stretched beyond this point the deformation is permanent (damage). This yield point behavior is exhibited due to the highly crystalline structure of HDPE, while Precidium™ ECS on the other hand is amorphous. After the 1 hour recovery period the samples were stretched until they broke. The extensometer was placed on the pre-stretched sections, and demonstrated that the pre-stretched area of Precidium™ ECS elongated much further than the HDPE before breaking.

Impact

Free film samples were subjected to several impacts at 320 inch-lbs using a BYK Gardner Impact Tester. Samples were then inspected for damage and change in thickness.

Conclusion

As shown in Table 1 and Figures below, Precidium™ ECS deforms elastically when stretched or impacted, recovering most of its original properties after the force is removed. By contrast HDPE deforms in a plastic manner and is permanently thinned and damaged by an applied force.

Material	Maximum Tensile Of undamaged Samples	Elongation at break for prestretched areas. (after 1 hour recovery)	ΔThickness after 200% elongation and recovery period of 1 hour.	ΔThickness after 320 psi impact
	(psi)	(%)	(%)	(%)
Precidium™ ECS	3225	118	18	0
HPDE	3698	30	61	72

Table 1: Results of impact and tensile testing

Figure 1: Recovery from 200% Stretching, from top down; HDPE, Precidium™ ECS, control

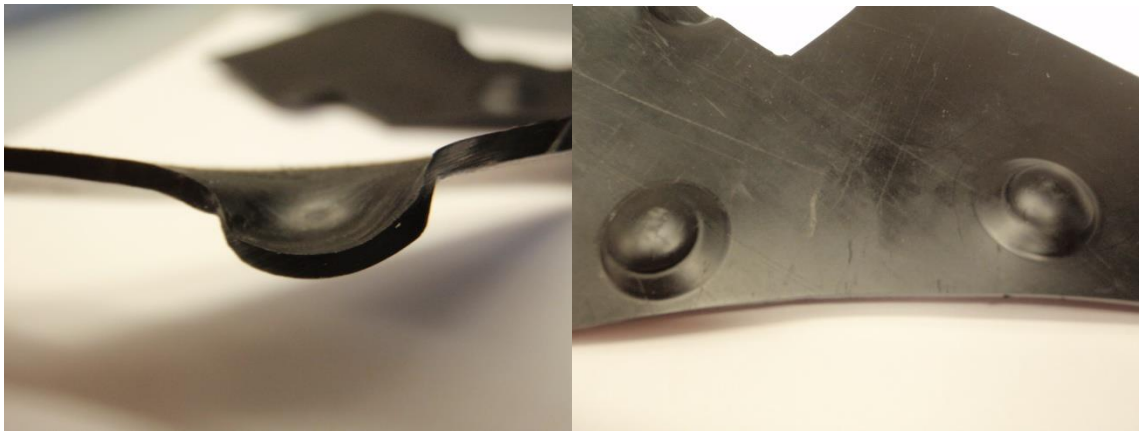

Figure 2: HDPE after 320 inch-lb impact, picture on the left shows the thinning along the outside of the impact zone.

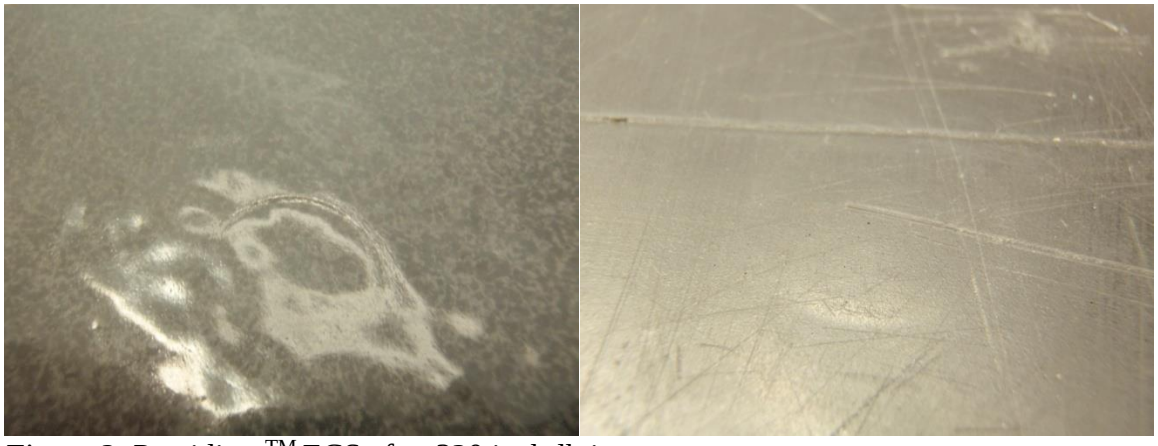

Figure 3: Precidium™ ECS after 320 inch-lb impact