# Impact Resistance

Application Note

## Overview

Impact resistance, or toughness, is defined by the relative susceptibility of plastics to fracture under stresses applied at high speeds. In materials science and metallurgy, impact resistance is a material's resistance to fracture when stressed. It is defined as the amount of energy per volume that a material can absorb before rupturing.

$$\frac{\text{energy}}{\text{volume}} = \int_0^{\epsilon_f} \sigma \, d\epsilon$$

The formula notation is defined as:

- ε - strain
- εf - the strain upon failure
- σ – stress

Many of today's appliances have to endure impact due to how they are used, accidents, safety requirements and more. The impact resistance of plastics can be improved by adding a soft material coating on top of hard plastic materials.

Listed below are examples of typical applications within given industries:

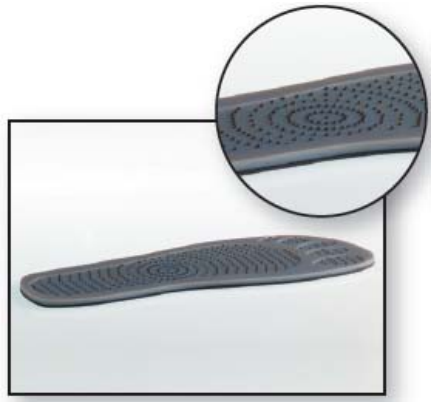
- Consumer Goods: Binocular protection, plastic container coverings, all-terrain personal equipment
- Consumer Electronics: Outdoor equipment for all-terrain purposes, laptops, outdoor GPS equipment
- Defense: All-terrain electronic equipment
- Toys: Baby toys, video game consoles, joysticks

**Figure 1:** VeroWhite and TangoBlack coating results

## Why Connex?

The Connex systems' ability to combine flexible and rigid materials can be used to produce various coating thicknesses and also different shore values of the coating material. Tests can be performed on the parts to measure the impact resistance obtained by the coating. By using the mixed tray option (rigid and soft

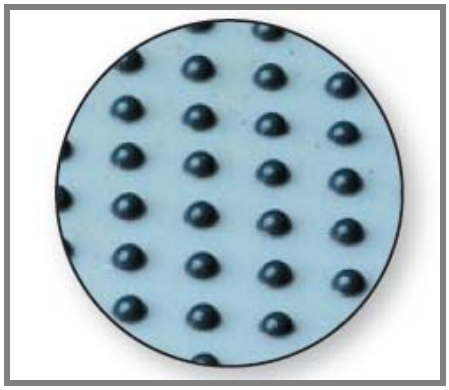
materials printed separately on the same tray), you can print various design versions with different coating structures, assemble the coatings on the rigid parts and test them to optimize your design.



## Tips and Tricks

- Save your design in separate STL files according to the different parts. This is recommended for flexible areas as well as for rigid parts. Later the parts can be printed in different color tones to visually separate the different areas of the model.
- Label each part that you evaluate with its relevant shore value. Labeling will help you easily determine which shore values received the highest toughness score in your evaluation criteria tests.
- Design your model in such a manner to enable the mounting of flexible parts on your full assembly of rigid and flexible parts. You can then use the Connex systems' ability to print up to 9 different materials in one build process and assemble each part on the model for evaluation.
- Coating: Use the Objet Studio™ software to coat parts with various thicknesses from 0.3-3mm with one mouse click. You can use any one of the different Digital Materials™ as the coating material.

  For example, to achieve a desired degree of flexibility use a flexible material from the Tango™ family as a thick coat (~3 mm) and a rigid material as the core (Figure 1).



## Reference

- White Paper Over Molding: Can be found under White Papers on the Objet website
- Case study: Can be found on the Objet website under Case Studies → Over Molding
- Movie Bio robotic model: Can be found on the Objet website under Movies

# Disclaimer

Objet Geometries Ltd. is not responsible for misuse of our products or their use in conjunction with unsafe or improperly maintained equipment or for uses other than intended as specified in this application note.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