

# Material differences in audio performance

Electronics such as smartphones, headphones, smart speakers, and home theaters are critical to daily life. They are also subject to daily use and stress. Eastman specialty plastics are excellent for enclosures and cases that protect sophisticated electronic technology while enhancing user experience by extending life and improving audio performance.

## LISTENING TO MARKET NEEDS

### What the consumer expects

In consumer research, Eastman discovered five properties that consumers demand:

- **GREAT AESTHETICS**—Must look and feel good with a quality appearance
- **DURABILITY AND TOUGHNESS**—Cracks, discoloration, and product failure are not acceptable.
- **SAFETY**—Extended skin contact underscores concerns about unwanted chemicals.
- **SUSTAINABILITY**—Consumers prefer to use biobased plastics, if performance is comparable.
- **PERFORMANCE**—Sound should be clear with minimal distortion, vibration, or feedback.

### What the brand owner demands

As electronics become smaller and more portable, manufacturers demand engineering plastics with greater processability:

- **THIN-WALLED PRODUCTS**—Superior flow for smaller devices and lighter-weight wearables
- **SECONDARY OPERATIONS**—Compatibility with adhesives, decoration, and printing
- **TINTABILITY AND COLOR RETENTION**—Consistent color supports brand image and customer loyalty.
- **PROP 65 COMPLIANCE**—Go to market without regulatory issues or disruptive warning labels.

## TESTING THE DIFFERENCES—DURABILITY

Eastman tested popular engineering plastics used in consumer electronics to compare performance in six areas:

### Chemical resistance and impact strength

Eastman's four-step testing protocol to test combined effect of impact stress and chemical attack is now the gold standard in medical applications.

### Durability under stress

Eastman conducted stress testing on headphones to replicate flex fatigue or failure after up to 72,000 cycles under 5% strain.<sup>a</sup>

<sup>a</sup>5% strain is commonly used in FFU testing—compatible with the 95th percentile of all heads.

## TESTING THE DIFFERENCES—ACOUSTIC PERFORMANCE

### Vibration damping

Tests using SAE J3130 methodology compared the damping loss factor (DLF) of four popular materials.

### Total harmonic distortion (THD)

THD sweeps were run on molded IEMs at 100 dB SPL nominal, and results were plotted.

### Cumulative spectral decay (CSD)

Eastman and DW Designs collaborated to compare CSD of in-ear monitors (IEM) molded from various engineering polymers. See CSD waterfall plots in Figures 1–3.<sup>b</sup>

### Subjective listener testing

Testing involved an expert panel of audio engineers, designers, and consumers.

Figure 1. Polycarbonate

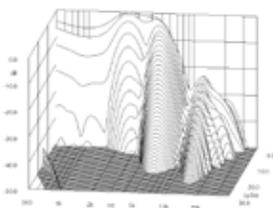


Figure 2. Copolyester

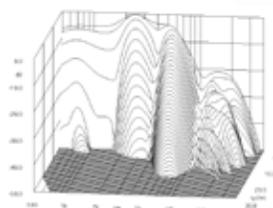
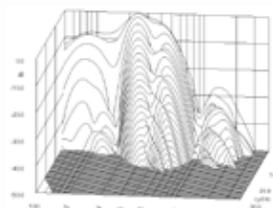


Figure 3. Cellulosic



## READY TO HEAR MORE?

Eastman would like to share results from all of these tests as well as videos, webinars, and reference guides. Contact us at [www.eastman.com/Consumer-Electronics](http://www.eastman.com/Consumer-Electronics).

<sup>b</sup>Molded IEMs (Periodic Audio Be [beryllium] technology) were tested in collaboration with DW Designs and Periodic Audio.

# Combining acoustic performance with reliability

Eastman Tritan™ copolyester and Eastman Trêva™ engineering bioplastic offer outstanding toughness and lasting good looks. Both are made without bisphenols, styrenics, halogens, or any of the other 850+ materials of concern listed in California Proposition 65 (Prop 65).

## Eastman TRITAN™ copolyester

- Proven in wearable electronics as well as portable and stationary devices
- Excellent impact strength and resistance to environmental stress cracking (ESC)—outstanding flex fatigue properties, withstanding ~72,000 cycles at 5% strain
- Best-in-class chemical resistance—including sweat and skin oils, lotions, and hygienic cleaners
- Design flexibility—excellent properties for processing and secondary operations
- Unique acoustic performance—evaluated in private and collaborative testing

## Eastman TRÊVA™ engineering bioplastic

- First engineering bioplastic—satisfies consumer demand for sustainable products
- Combination of properties unmatched by other bioplastics—or other engineering polymers
- Cellulose-based thermoplastic
- Excellent chemical resistance
- Excellent flow characteristics—ideal for complicated or thin-walled designs

---

*Trêva provides the opportunity to differentiate products with brand messaging based on biobased materials and environmental sustainability.*

---

Most important, both are backed by Eastman polymer expertise and technical support. For more information about Eastman specialty polymers for audio electronics, visit [www.eastman.com/Consumer-Electronics](http://www.eastman.com/Consumer-Electronics).

For test details and results, contact Alex Dudal, [adudal@eastman.com](mailto:adudal@eastman.com).

---

**EASTMAN**  
The results of insight™

**Eastman Corporate Headquarters**  
P.O. Box 431  
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)  
Other Locations, +(1) 423-229-2000

[www.eastman.com/locations](http://www.eastman.com/locations)

Although the information and recommendations set forth herein are presented in good faith, Eastman Chemical Company ("Eastman") and its subsidiaries make no representations or warranties as to the completeness or accuracy thereof. You must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment, or formulation in conflict with any patent, and we make no representations or warranties, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS AND NOTHING HEREIN WAIVES ANY OF THE SELLER'S CONDITIONS OF SALE.

Safety Data Sheets providing safety precautions that should be observed when handling and storing our products are available online or by request. You should obtain and review available material safety information before handling our products. If any materials mentioned are not our products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

© 2019 Eastman. Eastman brands referenced herein are trademarks of Eastman or one of its subsidiaries or are being used under license. The ® symbol denotes registered trademark status in the U.S.; marks may also be registered internationally. Non-Eastman brands referenced herein are trademarks of their respective owners.