

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.^a

^a5% 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.^b

Subjective listener testing

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

Figure 1. Polycarbonate

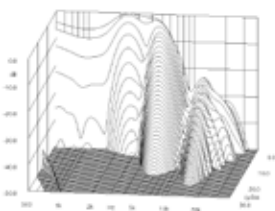


Figure 2. Copolyester

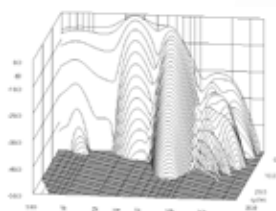
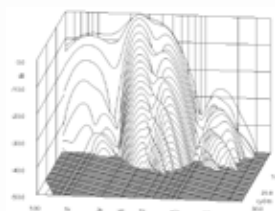


Figure 3. Cellulosic



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.

^bMolded 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 Trēva™ 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 TRĒVA™ 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

Trēva 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.

For test details and results, contact Alex Dudal, adudal@eastman.com.

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