

# Resist flex fatigue. Increase headband durability.

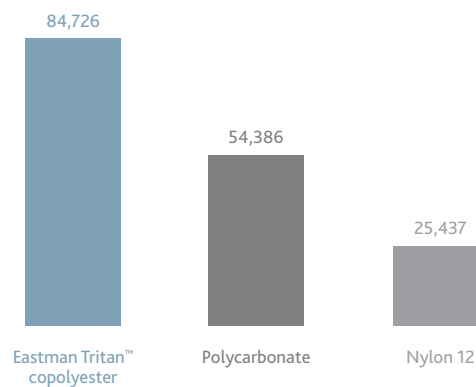
Headphones and other wearable devices require durability and toughness. This includes chemical resistance to body oils, cleaners, and other chemicals.

Headbands present a particularly challenging application because of the repeated flex stress cycles and the constant exposure to body oils, hair products, cleaners, and even food.

## FLEX FATIGUE TESTING

Eastman has conducted controlled flex fatigue tests on Eastman Tritan™ TX1001 copolyester, polycarbonate, and amorphous nylon (nylon 12). All material samples were subjected to ~5% strain<sup>1</sup> for repeated flex cycles using recognized cyclic flex methods. Each specimen was tested to failure, and the number of cycles was recorded (Figure 1).

**FIGURE 1. Average cycles to failure**



## CHEMICAL RESISTANCE TESTING

Environmental stress cracking (ESC) is the major contributor to plastic parts failure—especially those under repeated stress or impact.<sup>2</sup> Portable and wearable electronics such as headphones tend to be at higher risk for ESC due to the chemicals and levels of stress they are exposed to.

Table 1 compares the compatibility of Tritan and other polymers with common chemicals that frequently contact headbands. Tritan performed significantly better than competitive materials.

**TABLE 1. Chemical resistance**

		Retention in impact energy (%)			
		Eastman Tritan™ copolyester TX1001	Polycarbonate	PC/ABS	Nylon 12
Human interface	Sebum (skin oil)	●	◐	◑	◒
	Artificial sweat	●	●	●	◒
	Mayonnaise	●	◒	◑	◒
Cleaners	Clorox® wipes	●	◐	◑	●
	Windex®	●	◒	●	●
	Formula 409® cleaner	●	●	●	●
	70% IPA	●	●	◑	◒
Hair products	Morrocanoil® dry shampoo	●	◐	●	●
	Hairspray	●	◐	◑	●

Property retention based on reverse-side impact test method after 24 hours of strain exposure

- 80% to 100%
- ◒ 60% to 80%
- ◑ 30% to 60%
- ◐ 0% to 30%

<sup>1</sup>Strain of 5% is commonly used in FFU testing because it is compatible with the 95th percentile of all heads.  
<sup>2</sup>Polypropylene Definitive User's Guide and Databook, Plastics Design Library. New York, U.S.A. 1998.

## Combine acoustic performance with flex resistance.

Eastman Tritan™ copolyester offers a unique combination of performance characteristics that make it ideal for portable and wearable electronics:

- Outstanding toughness and flex fatigue resilience
- Lasting good looks and color retention
- Made without bisphenols, styrenics, halogens, or any of the other 850+ materials of concern listed in California Proposition 65 (Prop 65)
- Excellent impact strength and resistance to environmental stress cracking (ESC)
- Best-in-class chemical resistance, including sweat and skin oils, lotions, and hygienic cleaners
- Design flexibility with excellent properties for processing and secondary operations
- Outstanding acoustic performance evaluated in private and collaborative testing

Most importantly, Tritan is backed by Eastman polymer expertise and technical support.

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### READY TO HEAR MORE?

For more test results, videos, webinars, and reference guides, visit [www.eastman.com/Consumer-Electronics](http://www.eastman.com/Consumer-Electronics).

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