

## Energy Return Characteristics of EVA and E-TPU Midsoles

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### ABSTRACT

Expanded Thermoplastic Polyurethane (E-TPU) is a material used in shoe midsoles that has been described as having greater energy return than traditional Ethylene Vinyl-Acetate (EVA) midsole material. **PURPOSE:** The purpose of this study was to compare the landing and energy return characteristics of shoes using EVA and E-TPU midsoles. **METHODS:** Ten collegiate female athletes ( $19.7 \pm 1.0$  yrs,  $75.74 \pm 10.9$  kg,  $1.72 \pm 0.08$  m) volunteered and provided informed consent to participate in this study. Participants performed five drop jumps from a height of 50 cm under two conditions; while wearing EVA midsole shoes and while wearing E-TPU midsole shoes. Peak force, rate of loading and impulse were measured from a Bertec force plate sampled at 1000 Hz during the initial landing phase of the drop jump. Coefficient of Restitution (COR) was determined by measuring the bounce height of a 1 in steel ball bearing dropped from a 1 m height onto the shoes. All measures were compared between midsole conditions using paired t-tests. **RESULTS:** Peak vertical force when landing with the EVA shoe ( $3265.6 \pm 554.2$  N) was not different ( $p=0.19$ ) than when landing with the E-TPU shoe ( $3406.6 \pm 590.3$  N). Similar rates of loading ( $p=0.71$ ) were found for the EVA shoes ( $56106.3 \pm 9995.8$  N/s) and the E-TPU shoes ( $54232.4 \pm 12167.0$ ). Likewise impulse was not different ( $p=0.30$ ) between the EVA shoe ( $710.5 \pm 177.7$  Ns) and E-TPU shoe ( $693.9 \pm 162.6$  Ns). However, COR was slightly higher ( $p=0.01$ ) in the E-TPU shoe ( $0.67 \pm 0.05$ ) than the EVA shoe ( $0.66 \pm 0.02$ ). **CONCLUSION:** The difference in COR values coupled with the similar landing characteristics observed for the different midsole materials may suggest that individuals are able to compensate for material differences by using different physiological strategies such as using different muscle stiffness during the landing phase depending on midsole material. Further testing to examine physiological measures during these movements is warranted.