

Title: High Strength Impact Polymers.

Background: Researchers at Texas State University have succeeded in forming polymers with similar properties to Kevlar, but which can be processed by melt spinning and then woven. These polymers are formed from the reaction of cyclic diols with terephthalic acid and their properties can be tuned by adjusting the stereochemistry of the monomers used. High impact polymers are used in numerous applications ranging from reinforcement of marine ropes, industrial belts to structural reinforcement in the aerospace and automotive industry.

Benefits: In this work, the physical and mechanical properties of the polymer can be tuned by altering the composition of the monomers used. When only the trans form of the diol is used in the synthesis, an all trans, linear, high density polymer forms, which can be spun into highly aligned fibers, with tensile properties similar to Kevlar. When only the cis form is used, the resulting polymer is amorphous with a higher modulus and impact resistance than both the all trans and an amorphous polymer prepared from a mixture of isomers. In addition, the polymers have self-healing and shape memory properties, and high solvent and UV resistance. The polymers prepared do have exceptionally high impact resistance values. In addition the trans polymer can be melt spun, providing a much easier method of processing than for Kevlar, which is made by a condensation reaction followed by hot drawing, washing, neutralizing, drying and finally spinning and fabrication into a fabric.

Market Potential/Applications: In 2002, global production of Kevlar-type polymers was estimated at about 41,000 MT/year with annual increases of 5–10%. More recently, the global body armor and personal protection equipment market alone was predicted to be valued at \$19.4B over the next 10 years. This gives an indication of the sheer size of the global market for this kind of polymer.

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