Witold Brostow, Tea Datashvili, Haley Hagg Lobland, Lisa Su, Michael Thedford, Carolina Vanado and John White

THERMOELECTRIC DEVICES WITH HIGH TEMPERATURE POLYMERIC COATINGS

University of North Texas; Denton, USA

Thermoelectric (TE) generators convert temperature differences into electrical energy. The basis for their operation is a phenomenon called the Seebeck effect - discovered in 1821 by an Estonian-German physicist Thomas Johann Seebeck. Automotive TE generators could in principle recover usable energy from automobile waste heat given the temperature difference between the waste heat and the surroundings. TE refrigeration is also possible - based on the effect discovered by Jean C.A. Peltier, nearly simultaneously with Seebeck's discovery. Namely one can create a heat flux at the junction of two different types of conductors connected to a battery. This effect has been used in camping and portable coolers and for cooling electronic components and small instruments. In both thermoelectric generators and thermoelectric coolers the devices undergo repetitive thermal cycling over wide temperature ranges. Thermal cycling results in gradual deterioration of TE materials. Our work is focused on covering TE materials and TE devices with high temperature polymers (HTPs). Several properties are being determined for 'naked' TE materials and coated samples, before and after thermal cycling. Experiments include composition determination by EDS (energy dispersive X-ray spectroscopy), morphology of surfaces by scanning electron microscopy (SEM) and atomic force microscopy (AFM), isobaric thermal expansivity by thermomechanical analysis (TMA), electrical resistivity, thermal stability by thermogravimetric analysis (TGA) and adhesion of polymeric coatings to TE substrates determined by microscratch testing.