

Siemens Competition

Math : Science : Technology

Regional Finalist

Names: Gerald Hu, Sanchit Sachdeva, Susmitha Sayana

High School: Texas Academy of Mathematics and Science

Mentor: Dr. Witold Brostow

Project Title: *Polymer coatings for extended service life of thermoelectric materials and devices* (Environmental Science & Engineering; Materials Science/Nanoscience)

The potential utility of thermoelectric (TE) effects is hard to overestimate; however, at the present time, the usage of these effects is limited, leading TE effects to be overlooked by most. TE technology shows the possible elimination of liquid coolants by the use of solid state cooling devices, ultimately decreasing the rate of ozone depletion in the atmosphere. Extension of TE service life is possible by coating them with polymers that would prevent thermal degradation. While past research has confirmed that HTPs have high potential as sealants, only now has the effectiveness of the HTPs in protecting functional TE devices been proved. Nine selected HTP coatings were tested for their effectiveness against thermal degradation. Using baseline measurements of each TE device, particularly in the N and P skutterudites, polymer coating was synthesized through a specific curing cycle and passed through a series of tests to reveal its effect on the TE substrate. While nearly all HTP coatings lowered degradation of their TE substrate, HTP9 proved to be the candidates for industrial applications.