

## **Tensile strength properties of underground support liners**

**H. Ozturk and D. Guner**

Middle East Technical University, Turkey

**T**hin spray-on liners (TSLs) are fast curing, comparatively thin (2-5mm) and widely used rock support system in mining and civil engineering excavations. They have the advantages of low volume, rapid application and low operating cost. The majority of current TSLs are two part polyurethane/polyurea or Portland cement based latex products that are mixed on site before spraying onto surfaces. One of the important parameters that control the support mechanisms of TSLs is the tensile strength behavior of them. There are many different testing set-ups and tests have been conducted considering the physical properties of them. However, there are no studies exist on the tensile strength determination of TSLs based on some standard testing method. In this paper, for the first time in the literature, two different TSL products supplied by different manufacturers are tested. During laboratory studies, dog-bone samples that are prepared in the laboratory with different curing times (1, 7, 14, 21 and 28 days) are tested based on ASTM (D-638). It is concluded that the increase in the curing time increases the tensile strength of the TSL. The difference between the common malpractices of measuring the sample displacement from the loading machine versus from the sample's gauge length is observed to be significant.

### **Biography**

H. Ozturk (Ph.D., P. Eng.) received his B.Sc. and M.Sc. degree from METU, Mining Engineering Department in 1997 and 2000, respectively. He got his Ph.D from University of Alberta, Canada in 2005. After working as a consultant engineer in Canada for a while, he joined METU as an assistant professor in 2010. His main research interests are experimental and numerical rock mechanics.

ozhasan@metu.edu.tr

## **Nanocomposite thermoelectric materials - An answer for current energy crisis and for refrigeration**

**Hilaal Alam**

Qtech Nanosystems Pte Ltd, Singapore

**E**ven after two centuries since the Seebeck effect was discovered, no significant progress was made with the Thermoelectric (TE) Materials for commercial applications. The approaches to enhance the figure of merit ZT had been tough since the parameters are interrelated. Besides, the fabrication techniques are too expensive to use for viable applications. If the ZT can approach around 4 or 5 and the scaling up becomes simple, then the TE concept will become potential solution for the energy crisis and refrigeration. There was a renewed interest among the researchers to develop high ZT thermoelectric materials only in 1990s and the first decade of 2000s. Multi-wall Quantum Well, Complex structures and Nanoparticles started showing some potential way to increase ZT up to 2. The breakthrough came when the TE nanocomposites were developed and their fabrication techniques are likely to become cheaper. BiTe, GaAs, PbTe were commonly used as thermoelectric materials while Si was not shown much focus. The recent efforts were put on Si since its fabrication techniques were well established for more than half a century. The ZT of Si has been drastically increased nearly to 1 from fractions with the help of nanowire roughening techniques. With the matching materials, there are promising ways to increase the ZT. The nano-spinning fabrication method is currently explored for the inexpensive way of fabrication. On successful implementation, the cooling of electronics devices will become simple and their efficiency is expected to increase.

### **Biography**

Hilaal Alam has completed his MS from Indian Institute of Technology, Madras, India. He has published up to 5 papers in Nanopositioning systems. He holds a couple of patents and 4 more patents are still pending. He founded Qtech Nanosystems Pte Ltd, Singapore in 2007 to provide solutions in Nanopositioning systems. He has won two prestigious TECS grants from SPRING, Singapore to develop the precision power driver for nanopositioning and precision engineering. His recent focus is in thermoelectric materials and exploring with thin-film TE nanocomposites for cooling and power generation. He did his Bachelor of Engineering (Mechanical) from Bangalore University, India.

alam.hilaal@gmail.com