Center for the Commercialization of
Innovative Transportation Technology

Project Title: Cryogenic Super-Tough Steel for Bridges and other Applications

Principal Investigator:
Semyon Vaynman, Professor, Department of Materials Science and Engineering

Co-PI's:
Morris E. Fine, Professor, Department of Materials Science and Engineering
Yip-Wah Chung, Professor, Department of Materials Science and Engineering

Center Project Number: Y1-02
Total Project Funds: $ 82,586

Start Date: January 1, 2008
End Date: December 31, 2008

Abstract:
Higher toughness in steels permits the presence of longer fatigue cracks prior to rupture making it less likely that they would escape detection. Since steels become brittle at cryogenic temperatures, a steel with higher fracture toughness at low temperatures than existing steels is of interest for infrastructure applications such as bridges and tank cars. A steel (ASTM A710 Grade B) was developed at Northwestern University with FHWA and ITI financial support and with IDOT participation for bridge and other infrastructure applications This steel has a minimum of 70-ksi-yield strength significantly outperform previously used ASTM A36 and ASTM A588 bridge steels in strength, weldability and fracture toughness at low temperatures. There is interest in a steel with even much higher than for A710 Grade B steel fracture toughness at cryogenic temperatures for use by Northern states DOTs and also for tank cars that transport cooled liquids such as liquid chlorine.

We propose to develop and test a cryogenic super-tough steel by composition modification of our previously developed A710 Grade B steel. Based on our prior steel-development experience we will select 2-3 compositions, order heats from CANMET and in collaboration with IDOT and Union Tank Car Company (UTLX) will thoroughly investigate the mechanical, fracture, microstructural, welding and corrosion properties of steels. We will select the optimal composition for commercial implementation. We will contact Northern states DOTs and steel mills to market the steel for infrastructure as well as for other applications. We expect that at least one steel company will produce a small commercial heat and evaluate the mechanical properties. During the performance of the project we will prepare documentation for inclusion of the steel into appropriate standard.

We expect the cryogenic super-tough steel to respond to a need for a more fracture resistant steel for infrastructure, tank car, Homeland Security and other fracture critical applications.

1801 Maple Ave, Box 60 Evanston, IL 60201