

## **High Strength Ductile Glassy Nanomaterial Microwires**

A.V. Sergueeva, J. Walleser, B.E. Meacham and D.J. Branagan

### **Abstract**

High strength ductile Fe-based microwires were produced by the Taylor-Ulitovsky process. Previously, amorphous microwires were shown to exhibit exceptional magnetic properties but their mechanical properties were limited with very low or nonexistent tensile ductility. In this research, exceptionally ductile microwires with tensile ductility up to 8% are reported with high tensile strength (up to 5 GPa). The underlying reason for such unique property combination in the microwires is a formation of Spinodal Glass Matrix Microconstituent (SGMM) microstructure which enables the achievement of significant ductility due to suppressing of shear band propagation. Two distinct types of shear band interactions were identified. Induced Shear Band Blunting (ISBB) is a result of specific Localized Deformation Induced Changes (LDIC) in microstructure at the nanoscale upon shear band propagation leading to multiple shear band formation. Subsequent shear band arresting occurs by Shear Band Arresting Interactions (SBAI). Specific features of shear band interaction with each other and with microstructure resulting in global ductility of the materials are discussed.