Peter Lezzi

Title: *Strength Increase of Silica Glass Fibers by Surface Stress Relaxation: A New Mechanical Strengthening Method*

Abstract: Pristine silica glass fiber is well known to become mechanically weaker when heat-treated in the presence of water vapor. However, the same fiber was found to become stronger if heat-treated while held under a sub-critical tensile stress, at a temperature below the glass transition temperature, in the presence of water vapor. The added strength was attributed to the formation of a surface compressive layer on the glass created by a surface stress relaxation process that occurred while being held under the tensile stress. The presence and extent of surface residual stress formation was estimated from the permanent bending kinetics of glass fibers heated in the same atmosphere. The residual stress depth and magnitude in strengthened fibers was confirmed by FTIR, etching, and fiber polishing experiments. Ultimately, silica glass fibers with strengths estimated to be ~7-8 GPa were produced, exceeding the ~5.5 GPa strength of fresh optical fiber reported at room temperature in air. This process is a new glass strengthening method which can in principle be used for any oxide glass, but it is not subject to the constraints of currently available methods in that it does not require glass to have a minimum thickness, as in tempering, or alkali ions, as in ion-exchange.

Biography: Peter Lezzi is a PhD student under the guidance of Professor Minoru Tomozawa at Rensselaer Polytechnic Institute in Troy, New York where he also completed his undergraduate work. His research interests in the area of glass science include stress relaxation, water diffusion, mechanical strength, and the mixed alkali effect. Peter is able to pursue these interests in his graduate study thanks to a Graduate Fellowship from Corning Inc.’s Fundamental Research Department. He was also the recipient of the 2011 Alfred R. Cooper Scholars Award from the Glass & Optical Materials Division of ACerS.