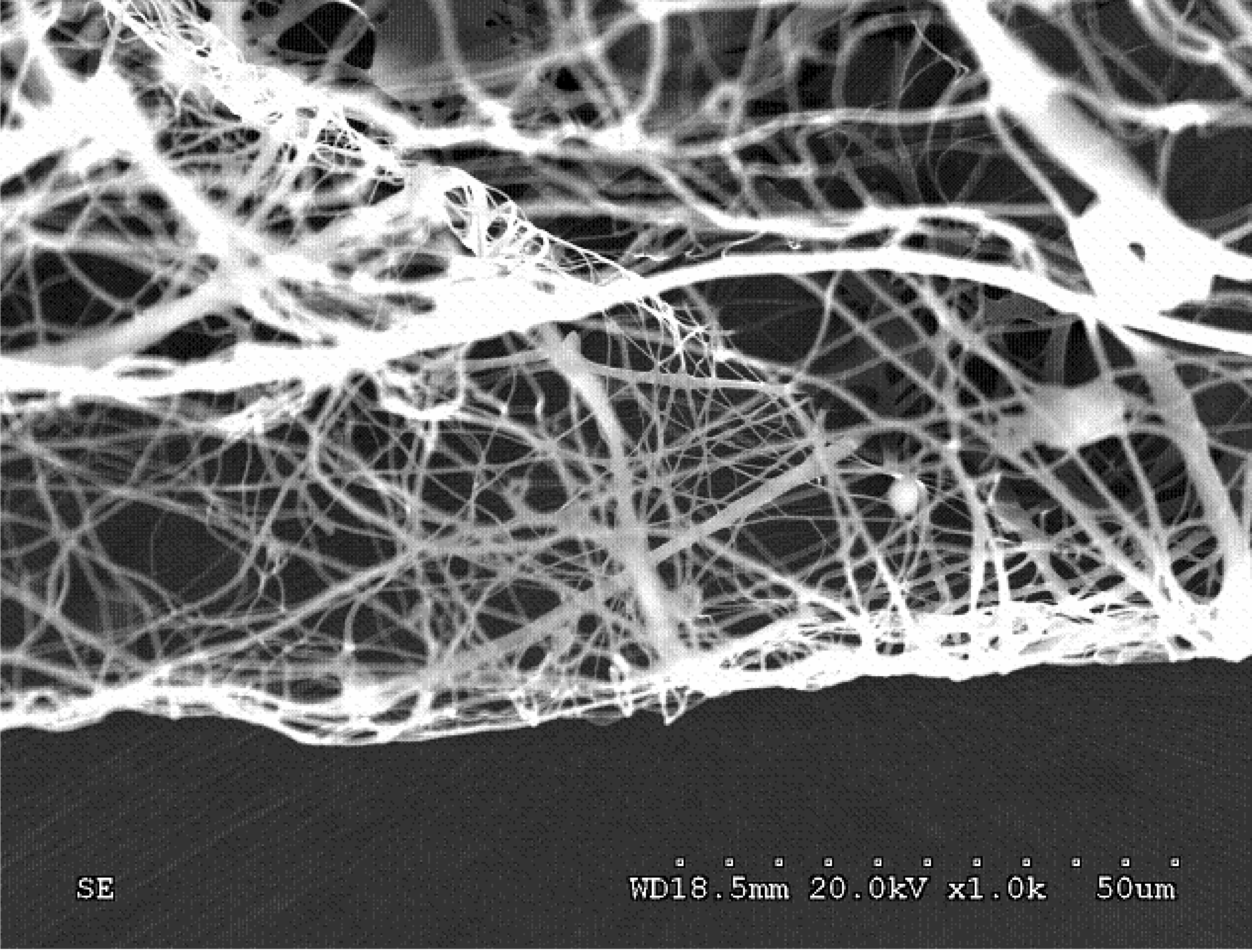


MERC 2008

November 28th 2008 10:00 - 12:00

Frank Forward Building Room 217

Department of Materials Engineering

The University of British Columbia

Vancouver BC

Materials Engineering Research Colloquium Schedule

Friday November 28th, 2008

Presenter	Time	Title
S. Gerami	10:00	Characterization of a Complex-Phase Steel
R. Shuster	10:30	Modeling of the Composition Variation during Casting of Titanium Alloy Ingots following Electron Beam Cold Hearth Re-melting
S. Yeoh	11:00	Electrospun Cellulose Ultra-Fine Fibers from Kraft Pulp
A. Kubiak	11:30	Thermomechanical Characterization of homogenized AA3003
LUNCH	**12:00**	

Characterization of a Complex-Phase Steel

Sepehr Gerami and Matthias Militzer
Department of Materials Engineering, The University of British Columbia

Research Summary:
A study of the the microstructural evolution of a complex-phase steel during thermomechanical processing, specifically hot-rolling, is underway. The purpose of the project is to produce a model capable of predicting the transformation behaviour of the complex-phase steel during hot-rolling. The effect of the heating, deformation, and cooling regime on the steel is being studied with the aid of a Gleeble 3500 thermomechanical simulator. A description of the experimental procedures will be presented, along with an analysis of the thermal simulation data generated to date.

Modeling the Composition Variation during Casting of Titanium Alloy Ingots following Electron Beam Cold Hearth Re-melting

Riley Shuster, Daan Maijer and Steven Cockcroft
Department of Materials Engineering, The University of British Columbia

Research Summary:

Titanium alloys are used extensively in the aerospace industry; most notably for rotating components in jet engines. The quality requirements for rotating-grade titanium are very high since small defects or inclusions can lead to catastrophic failures in service. Electron beam cold hearth re-melting (EBCHR) is a primary consolidation process often used before Vacuum Arc Remelting in the production of this grade of material which is capable of removing both high and low density inclusions.

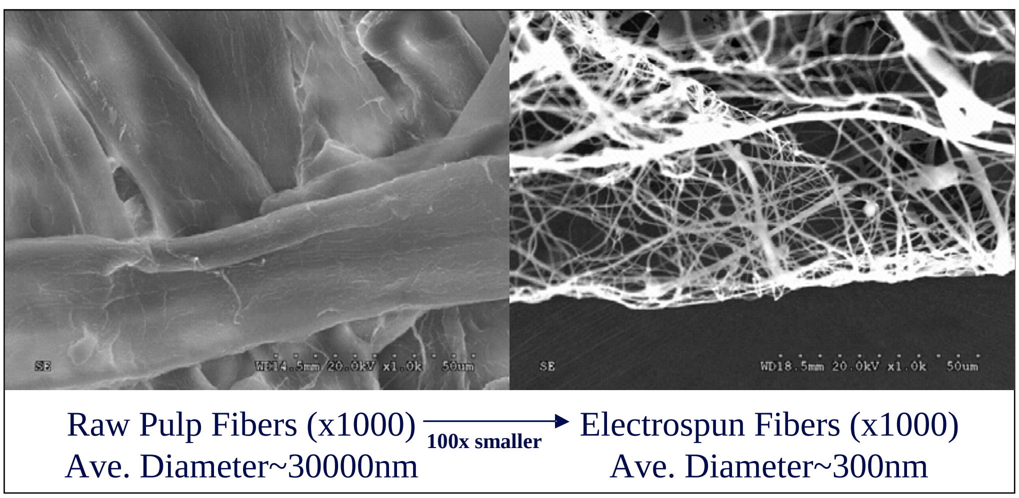
One of the principle concerns during the final stage of the casting process associated with EBCHR is the yield loss resulting from the formation of shrinkage voids in the upper portion of the ingots. It is possible to reduce the size of these shrinkage voids through a process called hot topping, where the top surface of the ingot is kept molten for a period of time after casting is complete. However, hot topping provides more time for evaporation of high vapour pressure alloying elements which results in portions of the ingot that do not meet alloy requirements. The purpose of the current work is to gain a better understanding of evaporation during the EBCHR casting process by developing a mathematical model capable of predicting the composition variation.

Electrospun Cellulose Ultra-fine Fibers from Kraft Pulp

Steve Yeoh[1], Wadood Hamad[2], Frank Ko[1]
[1]Department of Materials Engineering, University of British Columbia
[2]FPInnovations-PAPRICAN Division, Vancouver, BC

Research Summary:

Cellulosics, the world's most abundant biomass, include wood and other plant substances. The hydrophilic nature of cellulose renders the fibers highly susceptible to loss of mechanical properties upon moisture absorption. Furthermore, commercially available cellulose fibers have flawed surfaces and become mechanically weak upon moisture absorption, thus limiting their applications in high value-added paper products. The ability to fabricate moisture-resistant and mechanically stronger cellulosic fibres will potentially bring high value-added products, including structural and packaging materials, for the forestry industry. In this work, we aim to produce regenerated cellulose fibers of high strength and dimensional stability by electrospinning. We successfully demonstrated, for the first time, that kraft pulp could be electrospun into regenerated cellulose micro- and nano-fibers using kraft pulp/N-methylmorpholine oxide (NMMO) solutions. Various characterization techniques, including attenuated total reflectance (ATR) spectroscopy, micro-tensile testing, thermogravimetric analysis (TGA), and scanning electron microscopy (SEM), are used to establish structure-property relationships of the electrospun fibers.



SEM of Raw Pulp Fibers (x1000) and Electrospun Cellulose Fibers (x1000)

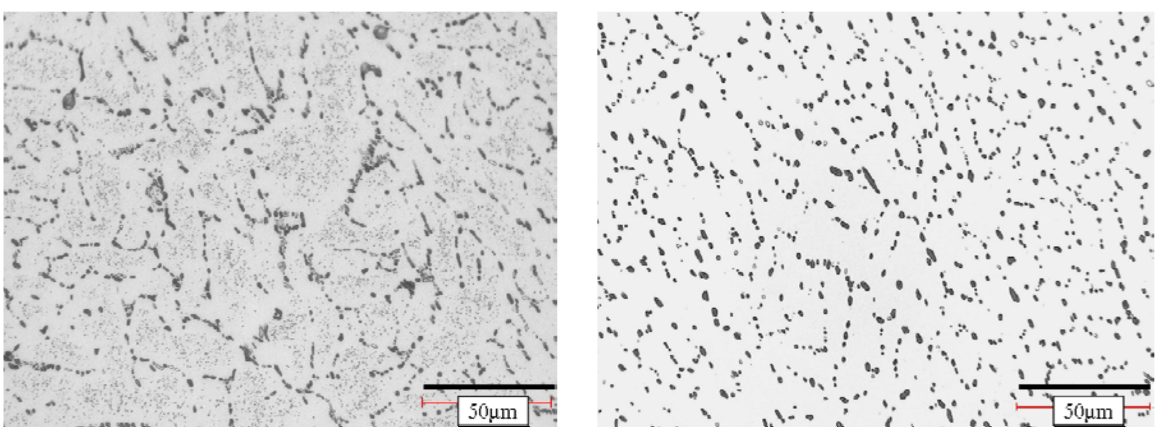
Thermomechanical Characterization of Homogenized AA3003

Angela Kubiak
M. A. Wells & W. J. Poole
AMPEL 411
Department of Materials Engineering, University of British Columbia

Research Summary:

AA3003 requires a homogenization heat treatment before it is extruded to decrease the amount of Mn in solid solution. The homogenization treatment influences the microstructural response of the material to subsequent thermomechanical processing as well as the final mechanical properties of the material. AA3003 is a non-heat treatable alloy that is finding increased use for heat transfer applications. Heating the as-cast structure precipitates dispersoids which then begin to dissolve at higher temperatures. Dissolution of the dispersoids continues throughout the soaking process; concurrently, constituent particles are growing and coarsening (shown in the micrographs below). Modeling of the homogenization and extrusion processes provides a means to optimize the industrial process in terms of extrusion pressure and final grain size.

In order to determine the amount of Mn in solution during homogenization, AA3003 samples were quenched at various points during the heat treatment and resistivity measurements were made. Compression samples, given diverse homogenization treatments, were characterized using a Gleeble™ thermomechanical simulator at several strain rates. The results of these tests have been found to conform to a physically-based flow stress model.



AA3003 sample homogenized at 600°C with a 1 hr soak (left) and a 24 hr soak (right)