ChE Graduate Seminar Series

Departmental Seminars Presented by Ph.D. Students

Stability Analysis of Polymer Fiber Spinning (Invited Talk)

Paresh P. Chokshi

10th January 2013, 0400-0440 pm, ChE Seminar hall

High strength polymer fibers are made by solution spinning technology. One of the major issues in polymer fiber spinning is the undesirable variations in fiber diameter resulting into poor quality fiber. One of the potential candidates responsible for the non-uniformity in fiber diameter is hydrodynamic instability that sets in during the spinning process. This instability, referred to as draw resonance, manifests in the form of sustainable periodic oscillations in the fiber diameter. In this talk, the draw resonance is analysed by using the linear stability theory for the extensional flow encountered in spinning. The fluid, a solution of entangled polymer, is appropriately described using the tube model to capture the non-linear rheology of the polymer. For infinitesimal amplitude disturbances, the instability is found to set in when the drawing speed exceeds a certain critical value. The critical parameter is found to be strongly influenced by the rheology of polymer as well as the processing conditions. The operating conditions for draw resonance are examined. We also establish the relation between the polymer rheology and the stability behaviour, which enables us to alter the polymer architecture such that the instability can be suppressed.

Studies on electro-electrodialysis cell for concentration of hydroiodic acid

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10th January 2013, 0440-0510 pm, ChE Seminar hall

Hydrogen is one of the most widely researched energy carriers for the future owing to the higher specific energy density and environmentally benign combustion product. Thermochemical cycles provide one of the most viable methods for large scale hydrogen production with relatively higher thermal efficiency (45-50 %) as compared to the other hydrogen production counterparts. Among the various proposed thermochemical cycles, Iodine-Sulphur thermochemical has the highest theoretical thermal efficiency of around ~ 50-51 %. However, the realized efficiency is low (~30-35%), primarily due to inefficiencies associated with concentration of hydriodic acid. Electro-electrodialysis (EED) is being explored as one of the efficient ways of concentrating hydriodic acid. Although, effect of different operating parameters on EED cell potential (and energy consumption) is reported a systematic study on contribution of different transport resistances to overall cell potential is absent. This is important to identify the main contributor to cell resistance and further optimization of the process.

The focus of this talk is on showing the use of under-limiting current chronopotentiometry, a simple electrochemical technique, for determining different transport resistances (and associated energy consumption) of an EED cell. In the studies, we identified four different energy consumption modes in the EED cell; the ohmic, the mass transfer, the electrodes reactions and open circuit voltage (OCV). The potential drop and corresponding energy consumption due to the electrode reactions was negligibly low compared to the other modes of energy dissipation. We found that during EED operation, the energy consumed by the first three resistances changed little with change in HI_x concentration but the OCV increases significantly and becomes the major energy consumption mode especially at low current densities for the desired EED exit HI_x concentration. Strategies to lower OCV of the cell are required to further reduce the energy consumption of the EED cell.

High Tea, 0510 pm

Attendance is compulsory for all PhD students.