Chemical Engineering

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Research Interests:

Three main research topics have been focused recently:

1. Nano-fibers preparation via electrospinning process

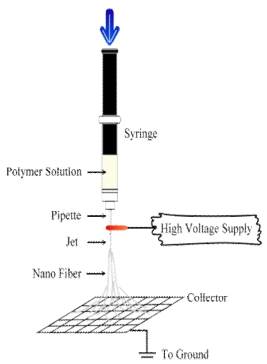
2. Structure/morphology/property relationships of polymer

3. Micro-phase separation of thermoplastic elastomers

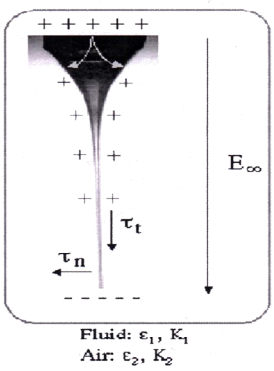
Nano-fibers preparation via electrospinning process

Functional fibers with a diameter of 20~1000 nm have been fabricated using electrospinning process in which the electric forces, instead of mechanical forces, are applied to drag the polymer jets into the desired sizes.

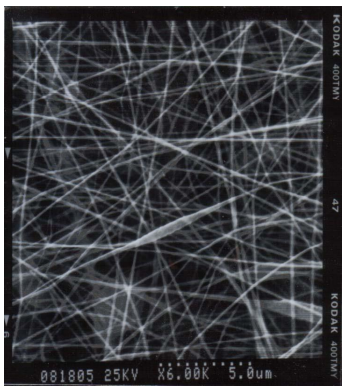
The effects of processing variables and rheological properties of polymer solutions on the morphology and internal structures of the nano-fibers have been studied.



Schematic setup of the electrospinning process.



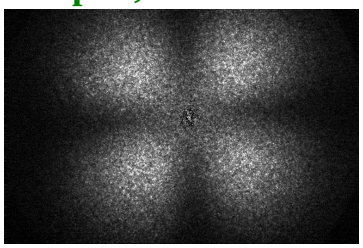
Electric field and stress near the liquid jet.



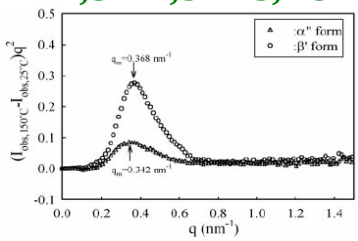
SEM of the electrospun PAN fibers.

Structure/morphology/property relationships of polymers

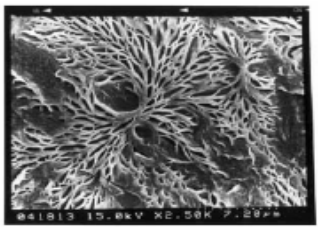
Syndiotactic/isotactic/atactic polystyrene and their blends provided systematic models to exhibit varieties of crystalline modification, lamellar structure, spherulitic morphology and phase segregation behaviors developed in these athermal systems. We have performed various characterization techniques on these samples, such as WAXD, SAXS, FTIR, TEM,SEM,SALS,POM, DSC.



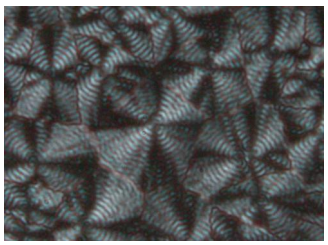
SALS Hv pattern of sPS showing the presence of spherulitic structure.



SAXS patterns of sPS with a'' and b'crystal forms.



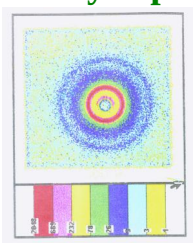
SEM of sPS/aPS blends (1:1) showing the interfibrilliar segregation morphology.



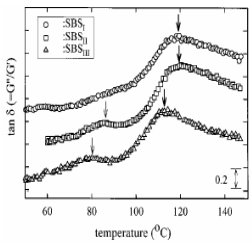
Polarized optical microscopy of PE showing spherulites with ring structure.

Micro-phase separation of thermoplastic elastomers

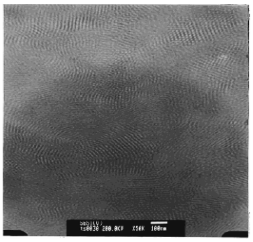
Effects of casting solvents and hot-press on the micro-phase separation and properties of SBS, SBS/PS blends and PP/EPDM have been investigated. The phase morphology is revealed by TEM and small-angle X-ray scattering. Rheological studies are conducted to observe the order-disorder transition temperature. The relation between tear strength and morphological features has been extensively explored.



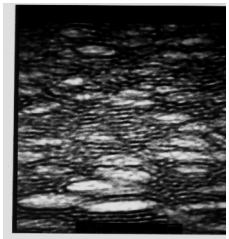
Two dimension SAXS pattern of SBS triblock copolymer showing the isotropic nature.



Dynamic rheological test showing the order-disorder transition of SBS.



TEM image of SBS cast from toluene solution showing the micro-phase separation domains.



Macro-phase and micro-phase separation revealed by TEM in SBS/PS blends.