

ORAL SESSION 5: MATERIALS CHEMISTRY AND NANOSCIENCE, LECTURE THEATRE - PLT 1 (303-G20),
 NOVEMBER 23, 2022, 11:00 AM - 12:35 PM

CHARACTERIZATION AND SURFACE CHEMICAL MODIFICATION OF MUSSEL SHELL: PROBING ITS POTENTIAL APPLICATION AS A BIO-FILLER IN A POLYMER-SHELL COMPOSITE

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This work investigated mussel shell's potential as a bio-filler for polypropylene (PP). Micron-scale mussel shells were obtained by ball milling. Both aragonite and calcite were identified in mussel shell through Fourier transform infrared spectroscopy (FTIR), Nuclear magnetic resonance spectroscopy (NMR), and X-ray diffraction (XRD). The aragonite and calcite percentages in mussel shell were estimated with X'Pert Highscore Plus software at 54.9% and 45.1%, respectively. Mussel shell shows a minimum weight loss (<5 wt%) at temperature below 650°C as revealed by thermogravimetric analyses, indicating it is sufficiently thermally stable for compounding with polypropylene. A better compatibility with hydrophobic PP matrix was achieved by mechanochemical modification of hydrophilic mussel shells using maleic anhydride grafted polypropylene (MAPP) alone or in combination with polydopamine (PDA) coating. Inspired by the super-adhesion of

mussel foot protein, self-polymerized dopamine deposited a PDA layer on mussel shell particles, which can serve as a bridge between mussel shell and MAPP. XRD analysis indicated that PDA coating did not affect the mussel shell's crystal structure. Both MAPP and PDA/MAPP modified mussel shell showed a higher hydrophobicity according to contact angle measurements. Using the Fowkes model, the surface energy of pristine and modified mussel shells was calculated from contact angle measurement data. The PDA/MAPP-mussel shell exhibits similar surface energies to PP, indicating its surface compatibility with PP when added as a filler. Overall, mussel shell is a promising and sustainable substitute for the mineral CaCO₃ as fillers for polymer composites and its properties in mussel shell/PP composites will be further investigated.