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POLYMER NANO-COMPOSITES: A NEW LABORATORY PREPARATION TO AFFECT AND CONTROL INTERCALATION AND EXFOLIATION

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When compounding nanocomposites, the processing challenge is in getting the best *dispersive* mixing possible to intercalate and exfoliate the nanoadditives in the polymer matrix. Over the years, several laboratory mixers have been developed for academic research and these are essentially miniature versions of industrial twin screw extruders working in a recirculation mode to allow sufficient mixing time. Because mixing in these devices is carried out in the melt phase, none can produce sufficient elongational mixing- key to intercalation and exfoliation. We propose in this paper to submit nanocomposites produced in such minimixers to a further stage of high stress biaxial elongation performed in the *solid* phase. The nanocomposites (PP/Cloisite) is thus first produced in the melt phase at 190^0C, cooled to room temperature upon exiting the mixer and then biaxially stretched as *near solid*, so that the stresses are almost 3D and large enough to induce intercalation and exfoliation. We measure this additional dispersive mixing through rheology and microscopy of the melted samples at 190^0C, i.e. the memory of the polymer orientation is removed and only the effect of biaxially stretching on intercalation and exfoliation is being measured. Our proposition is that if very good dispersion of the nano additive in the polymer matrix has occurred then rheological tests should depict this fully. In the presentation, the experimental method will be described and the pertinent rheology and microscopy data presented to support the claim, that our combined new mixing and stretching *device* can produce nanocomposites at controlled levels of intercalation and exfoliation-key in the development of these important new materials which hitherto have offered great promises but remain elusive.