ULTRASONIC INVESTIGATION OF POLYMER BLENDS

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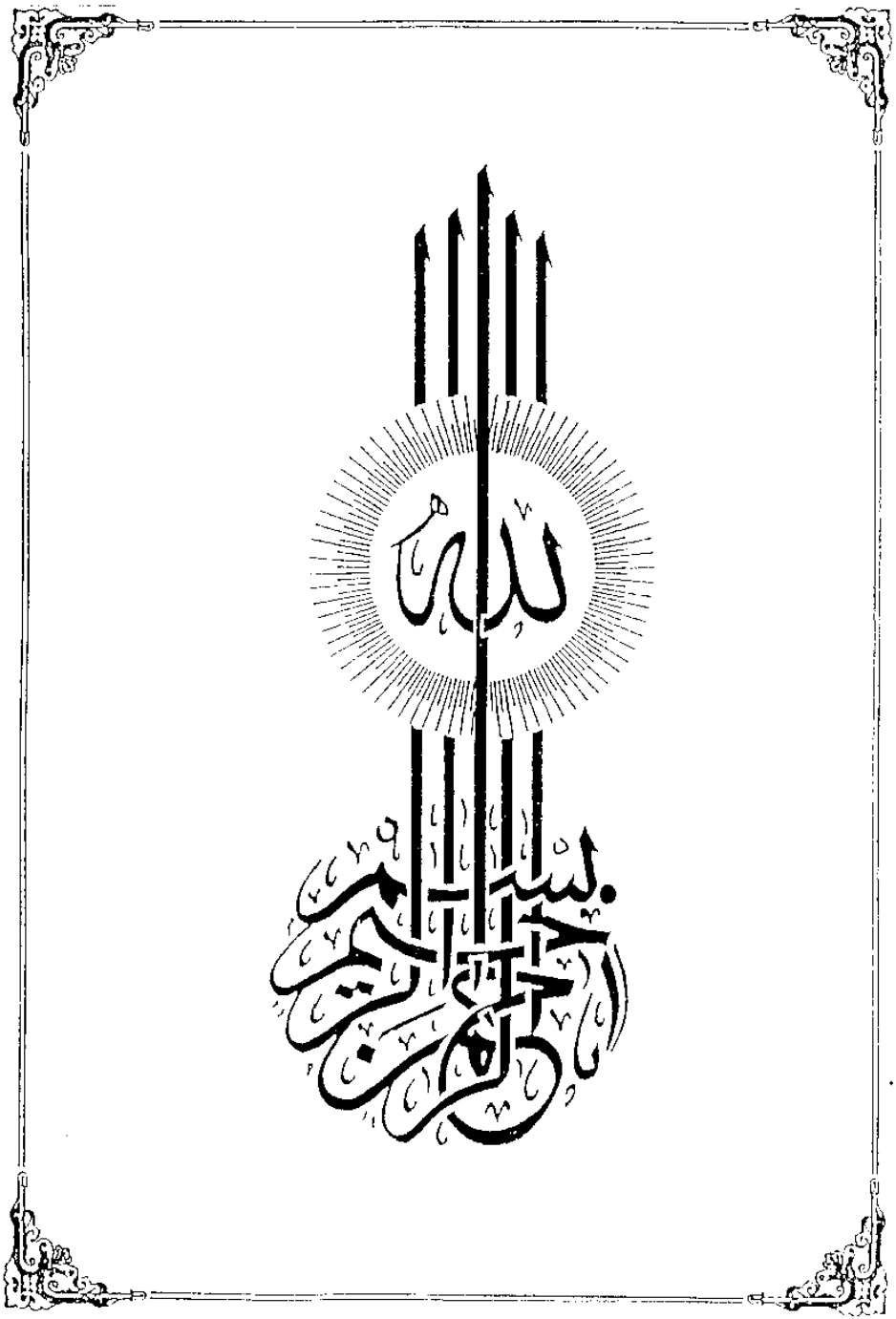

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Summary

All rubbers have shortcomings in one or more properties. The use of two or more different polymers to produce a polymer blend is becoming increasingly important for the preparation of materials with new desirable properties absent from the component polymer. Polymer blends are defined as a physical mixtures of structurally different polymers which interact through secondary forces.

Rubbers are often blended to obtain a lower cost material with better processing behaviour, intermediate between that of the components. These blends can be either homogeneous (compatible) or heterogeneous (incompatible). Therefore, the compatibility is the fundamental property in polymer blends deciding their practical utility.

The scheme of the present study covers the following :

1. Measurements of the compressional ultrasonic velocity in both blend solutions and solid polyblends using pulse echo technique.

3. Only one single transition temperature was observed for compatible blends indicating unambiguous evidence of miscibility, while two transition temperatures exist for incompatible blends indicating the existence of a multiphase structure.
4. Compatibility is either described as thermodynamic compatibility satisfying the equation,

$$\Delta G_m = \Delta H_m - T \Delta S_m \leq 0$$

where ΔG_m is the free energy change for mixing.
ΔH_m is the heat of mixing.
ΔS_m is the change in entropy.

or technological compatibility blends which means that their blends are technologically useful. The calculation of heat of mixing for compatible blends using Schneier's equation gave values lower than 41.8×10^{-3} Joule. i.e below the limit of compatibility and this agrees well with Schneier's calculations while for incompatible blends, the value of heat of mixing exceed the upper limit of compatibility.

5. The variation of adiabatic compressibility with composition is linear for compatible blends while it deviates from linearity for incompatible blends.

6. Additional experiments; scanning electron microscopy and infrared spectroscopy confirmed the results obtained from ultrasonic investigation and heat of mixing calculations.