In spheres and found that the scatter

In the presentscenario, the need of high strength materials is arising day by day.

Forfulfilling this need, initially polymers were introduced, then in the recenttime the concept of polymer nanocomposites was introduced. Polymernanocomposites are having two basic constituents, Polymer matrix and Nano levelhigh strength inclusion (e. g. Alumina, Silica etc.).

The Polymer Matrix ishaving certain Mechanical properties, which are strength wise quite less thenthe Mechanical properties of the nanofiller to be included to the PolymerMatrix But upon including a very little amount of the nanofiller to the PolymerMatrix , we get the Polymer Nanocomposite, which is having quite better and usefulproperties then the Polymer taken.
Now when the nano sized filler (orderof 100 nm)is included into the bulk polymer via certain chemical and mechanicalprocesses, there is a formation of an Interphase in between the Inclusion andthe Polymer Matrix. This interphase connects the Polymer with the inclusion andthe properties are not constant or certain in this interphase area. Now themotto of our work is to analyze about the nature of the properties of thisinterphase and effect of varying the interphase properties on the overallMechanical properties of the Polymer Nanocomposites.   The interface of a composite material playsa large part in the effective properties of the material. The role of theinterface in the strength of composite materials has been addressed in theearly study of composites by Tsai and Hahn (1980)1. Drugan and Willis (1996) statethat the minimum size of the RVE is the smallest volume element of thecomposite that is ” statistically representative of the composite”. They haveshown that the minimum RVE size is at least twice the diameter of

thereinforcement, citing a maximum error of five percent in elastic constantsobtained with this RVE size2.

Gusev (1997) studied disordered periodic elasticcomposite unit cells composed of various numbers of identical spheres in orderto determine the scatter in elastic constants obtained with different numbersof spheres and found that the scatter is small with only a few dozen spheres inthe cell3. Whenhomogeneous boundary conditions are applied to a macroscopic composite, thedeformation in each RVE is identical and the deformation along each RVE edge iscompatible. Consequently, the mechanical response of a composite material canbe obtained by applying periodic boundary conditions to a single RVE. Theconventional method of applying periodic boundary conditions has been to pairnodes on opposite faces of the RVE. This method has been used by Segurado andLlorca (2002)4 and Berger et al. (2005)5.

In the conventional node-couplingscheme, opposite nodes on opposite boundaries of the RVE must be paired to ensurecontinuous deformation. For each pair of nodes with the same in-planecoordinates, the displacement components on the coupled boundaries areconstrained with a constraint equation. This pairing of nodes ensures periodicdeformation and compatibility on opposite sides of the RVE. Imposing theconstraints on opposite nodes according to this conventional node-couplingscheme can mean enforcing thousands of constraint equations, resulting in avery time-consuming task to impose the periodic boundary conditions on the RVE.   Most important about polymer nanocompositesis that these superior properties are achieved at very low loading levels of inclusions, so the parent polymer does not sacrifice the advantages of low density and highprocessibility. These extraordinary behaviors make polymer nanocomposites apromising multifunctional material in many fields, including the aerospace, automotive, and medical device industries. A variety of nanoparticlesmorphologies have been considered, including spherical particles (e.

g. silica), platelets (e. g. clay and graphite) and nanotubes 6.

Polypropylene is used as the basepolymer in this case and Alumina is taken as the inclusion. The analysis isdone on the ANSYS platform taking a Representative Volume Element (RVE) ofsquare shape with a side of 200 nm.