In this presentation, we will address some of the new developments in the micromechanical modeling of the thermomechanical behavior of polymers and polymer nanocomposites. Different polymer matrices, unfilled or filled with different nanofillers, are considered. For this, we developed an approach that is valid for a wide range of loading rates, from quasi-static to dynamic loadings, as well as for a wide range of temperatures, from well below to above the glass transition. Microstructural and interfacial effects are also accounted for. For the semi-crystalline matrices and for the composites, different homogenization techniques used to compute the effective elastic and yield properties. In this, microstructural and interfacial effects are accounted for. These techniques are also used, as inverse methods, to predict the microstructure for a given macroscopic response. Our predicted results are compared to our experimentally measured ones.