FULLERENE-RICH NANOSTRUCTURES

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In recent years, the rapid advances in dendrimer synthetic chemistry have moved towards the creation of functional systems with increased attention to potential applications.[1] Among the large number of molecular subunits used for dendrimer chemistry, C_{60} has proven to be a versatile building block and fullerene-functionalized dendrimers, i.e. fullerodendrimers,[2] have generated significant research activities in recent years.[3] In particular, the peculiar physical properties of fullerene derivatives make fullerodendrimers attractive candidates for a variety of interesting features in supramolecular chemistry and materials science.[4] C_{60} itself is a convenient core for dendrimer chemistry[3] and the functionalization of C_{60} with a controlled number of dendrons dramatically improves the solubility of the fullerenes. Furthermore, variable degrees of addition within the fullerene core are possible and its almost spherical shape leads to globular systems even with low-generation dendrons. On the other hand, specific advantages are brought about by the encapsulation of a fullerene moiety in the middle of a dendritic structure.[5] The shielding effect resulting from the presence of the surrounding shell has been found useful to optimize the optical limiting properties of C_{60} derivatives, to obtain amphiphilic derivatives with good spreading characteristics, or to prepare fullerene-containing liquid crystalline materials. The use of the fullerene sphere as a photoactive core unit has also been reported.[6] In particular, the special photophysical properties of C_{60} have been used to evidence dendritic shielding effects and to prepare dendrimer-based light-harvesting systems. Whereas the main part of the fullerene-containing dendrimers reported so far have been prepared with a C_{60} core, dendritic structures with fullerene units at their surface or with C_{60} spheres in the dendritic branches have been much scarcely considered. This is mainly associated with the difficulties related to the synthesis of fullerene-rich molecules.[3] Indeed, the two major problems for the preparation of such dendrimers are the low solubility of C_{60} and its chemical reactivity limiting the range of reactions that can be used for the synthesis of branched structures bearing multiple C_{60} units. Over the past years, we have developed a research program on the synthesis of dendrons substituted with fullerene moieties.[3] These fullerodendrons are interesting building blocks for the preparation of monodisperse fullerene-rich macromolecules with intriguing properties. This specific aspect of fullerene-containing dendritic systems has been summarized in a recent review article[3] and will not be discussed in the present paper in which the most recent developments on the self-assembly of fullerene-rich nanostructures will be presented.

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