Preparation of Multilayered Organic-Inorganic Nanohybrids via Layer-by-Layer Assembly

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Layer-by-layer (LbL) assembly of oppositely charged polyelectrolytes is widely used as a versatile method for preparation of core-shell particles. Not only polyelectrolytes (PEs) but also a number of materials having multivalent charge, e.g., inorganic nanoparticles, are applicable for the layer-by-layer assembly technique [1]. Therefore, a novel class of organic-inorganic composite materials can be easily obtained by the incorporation of inorganic matters for LbL process. In this study, several organic-inorganic composite core-shell particles and hollow capsules were prepared via the layer-by-layer assembly technique. As an inorganic component, TiO_2 was chosen as a photocatalyst. PEs-TiO_2 composite capsules are expected as control delivery vehicles (Fig. 1).

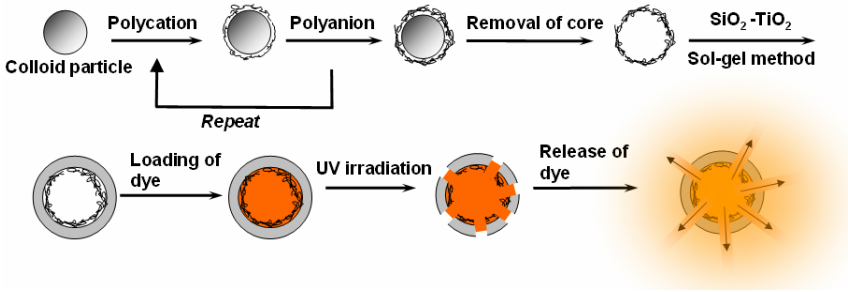

Fig. 1. Schematic representation of the formation procedure of organic-inorganic composite hollow capsule via layer-by-layer assembly technique with colloidal template.

The UV responsive property of the hollow capsules was confirmed by release of dye molecules (Phenol Red) upon UV irradiation. In the case of the capsule formed with PEs and SiO_2, the dyes were not released from the capsules even after irradiation for 1 h. On the other hand, the dyes were quickly released upon UV irradiation for 5 min for the capsules formed with PEs and SiO_2-TiO_2 (Fig. 2). It should be owing to formation of holes in the capsule shells by the photocatalytic decomposition of organic PE multilayers.

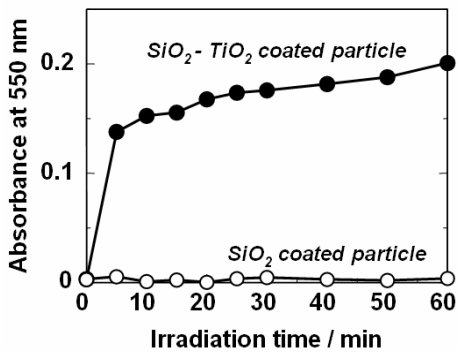

Fig. 2. Changes in the absorbance of phenol red released from the $(PSS/PDDA)_5$/ SiO_2 or SiO_2-TiO_2 particles as a function of UV-irradiation time.

[1] F. Caruso, ed, *Colloids and Colloid Assemblies* (Wiley-VCH, Weinheim, 2004).

Biographical Sketch

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