Séminaire à l'UFR de Chimie - Bâtiment Lavoisier - salle 774
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Carbon Dots – Metal Oxide nanocomposite films with controlling functional properties using surface interaction

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Carbon dots (C-dots) are of great interest as they show the unique photoluminescence properties in aqueous solution in spite of carbon-based nanomaterials. In the meantime, C-dots based solid-state systems, like emitting device have not yet been well-designed to achieve an efficient emission due to the difficulties in dispersion and in preventing reabsorption by surrounding substances. If the design of C-dots based nanocomposite systems are realized, the application fields must be expanded not only as emitting devices but also as conductive and electrochemical materials. In this seminar, C-dots – Metal Oxide nanocomposite systems are reviewed, using the different nanostructured composite systems to induce their specific interaction between the C-dots and Metal Oxide. Such a nanocomposite system, the unique surface properties of C-dots are the most important and useful for the incorporation with metal oxide matrices, such as SiO_2, ZnO, TiO_2 and so on. Also to achieve the wide range of design by controlling the chemical reaction, we use the solution process such as sol-gel method and hydrothermal synthesis to prepare the nanostructure-controlled composite films. In this seminar, several nanostructures with specific functional properties are introduced. For instance, ZnO – C-dots mesoporous films can induce the energy transfer from ZnO into C-dots, which enhance the luminescence of C-dots (Figure 1(a)).[1,2] Meanwhile, when the C-dots are much impregnated onto ZnO macroporous surface, a reducing effect on ZnO are observed (Figure 1(b)).[3] For the improvement of dispersibility of C-dots into the matrix, the surface of C-dots is functionalized by the organoalkoxysilane, which can be part of matrix (Figure 1(c)).[4] Another advanced electrochemical functionalities are being explored in a titania nanofunnels (TNFs) – C-dots system. Vertically-oriented TNFs against conductive substrate are prepared and make compositation with C-dots, which can achieve the efficient electron transport for water splitting devices (Figure 1(d)). These designing of nanocomposite films using solution process can be one of the promising strategies to use C-dots efficiently for solid-state systems.

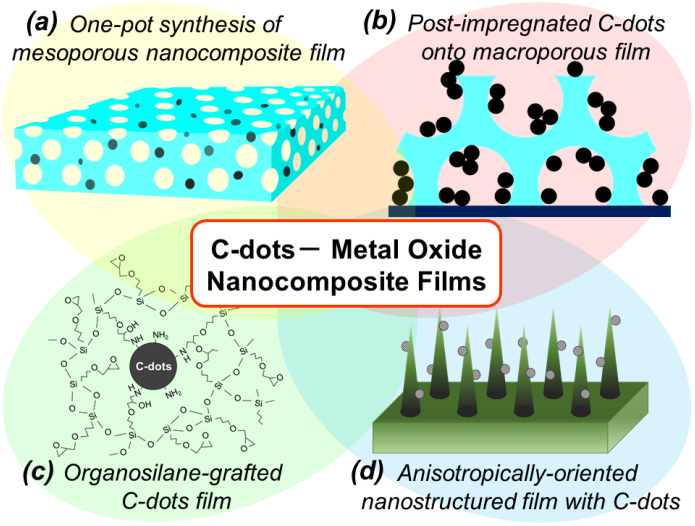

Figure 1. Synthetic designs of Carbon Dots – Metal Oxide nanocomposite films for advanced functional properties.

References

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2. C. M. Carbonaro, L. Malfatti, K. Suzuki, *et al.*, *J. Phys. Chem. C*, 122, (2018) 25638–25650.
3. K. Suzuki, M. Takahashi, L. Malfatti, P. Innocenzi, *RSC Adv.*, 6, (2016) 55393–55400.
4. K. Suzuki, L. Malfatti, M. Takahashi, F. Messina, *et al.*, *Sci. Rep.*, 7, (2017) 5469.