CORE
Metadata, citation and similar papers at core.ac.uk
Provided by Community Repository of Fukui

Size-dependent efficiency of electron transfer at suspended redox latex

Koichi Aoki, Jingyuan Chen*
Department of Applied Physics, University of Fukui
*d020111@u-fukui.ac.jp

Particle size often alters physical properties such as in luminescence, conductivity, vacancy formation energy, melting points and evaporation temperatures of nanoparticles. Metal nanoparticles are exemplification of exhibiting size-dependent optical and electronic properties. As their particle size decreases, the surface plasmon adsorption peak shifts to a higher energy region [1], as has been explained in terms of the Mie theory [2]. Size-dependent chemical properties are well documented in the field of metal cluster chemistry [3]. Redox latex is a large particle with a number of redox sites of one or more kinds of redox couples in one particle. Size-dependent may manifest owing to molecular interaction or assemblies.

Redox latex was synthesized by coating near-monodisperse polystyrene latex particle with redox species, or by copolymerization of redox species and styrene. The size of polystyrene particles was controlled with concentrations of styrene, of potassium persulfate, and of sodium dodecylsulfate (SDS) as a steric stabilizer (Table 1). There are basically two types of distribution: one being the core-shell structure at which redox sites are included only in the shell, the other being uniform distribution of redox sites over the particle. The former was formed by coating hydrophobic cores, polystyrene, with hydrophilic shells, such as polyaniline-coated latex, ferrocene-carboxyl immobilized polyallylamine-coated latex. In contrast, latex with uniform distribution was constructed by adsorbing hydrophobic redox sites into hydrophobic porous particles. We will explain in details by presentation. The measurement and analysis are basic of electrochemical, spectroscopic and optical methods. The voltammetric responses of the particles in suspensions are examined in the context of partial electron reactions.

diameter	Ethanol	water	2-propanpol	Methoxyethano	SDS	stirring	Styrene	PVP	AIBN
μm	cm^3	cm^3	cm^3	cm^3	g	rpm	cm^3	g	g
0.202	0	120	0	0	0	400	8	1.52	0.15
0.402	0	100	20	0	0.15	400	8	0	0.15
0.567	0	0	120	0	0	350	10	1.5	0.15
0.886	0	0	120	0	0	350	10	3	0.15
1.08	40	0	0	36	0	160	15	1.52	0.33
2.06	90	0	0	60	0	200	25	4.5	0.25
3.90	18	0	0	12	0	120	5	0.8	0.08
6.42	18	0	0	12	0	120	5	0.53	0.11
7.50	18	0	0	12	0	120	10	0.5	0.25

[1] (a) X. Wang, E. D. Sudol, M. S. El-Aasser, *Langmuir* **17** (2001) 6865. (b) M. Fujii, T. Nagareda, S. Hyyashi, K. Yamamota, *Phys. Rev.* B **44** (1991) 6243. (c) S. Tsunekawa, A. Kasuya, Y. Kawazoe, *IPAP Conference Series*, **3** (2001) 88. (d) X. Ma, W. Shi, *Microelectronic Engineering* **66** (2003) 153.
[2] G. Mie, "*Contributions to the optics of turbid media, particularly of colloidal metal solutions*," Royal Aircraft Establishment Library Translation 1873, (Her majesty's Stationery Office, London, **1976**).
[3] Moraga, G. G. "*Cluster Chemistry*," Spring-Verlag Chapter 2, **1993**, Berlin.