

Nanocapsules – valuable tool for refinement of the microscope

S. Krol, M. Schneider, R. Magrassi, F. Federici, G. Vicidomini, A. Gliozzi, A. Diaspro
INFM and Department of Physics, University of Genoa, 16146 Genoa, Italy.

Since multilayered nanometer-thick polyelectrolyte capsules, deposited by Layer-by-Layer technique^{1,2}, were established in the late nineties they are a useful tool in most areas of science like biophysics, medicine, nanobioscience, and pharmacy. The encapsulation of charged surfaces with oppositely charged synthetic or natural polyions has become fashion in order to change, and somehow tune, the properties of the coated material. Recently, synthetic colloidal particles³, crystalline proteins⁴, living⁵ and fixed cells⁶, artificial tissue⁷ and glass surfaces were successfully coated by varying polyelectrolyte couples. These small shells reveal protective abilities for the encapsulated organisms. Release control and in-out permeability of the capsules can be assumed. The charged capsule wall allows the immobilization of the encapsulated material on charged material, e.g. in case of biosensor systems. Moreover the polyelectrolyte surface permits binding of antibodies or lipid layer and so the system is a promising candidate for targeted and smart drug delivery.

From the microscopic point of view nanocapsules are a valuable system. In fact, layer thickness and other properties can be modified by modulating pH or ionic strength during or after preparation⁸. So far, they can be used for calibrating FRET experiments or PSF determination. Furthermore fixation of fluorescent dyes on the capsule wall allows determination of diffusion through the capsule or the measurement of the local pH in uncaging experiments⁹.

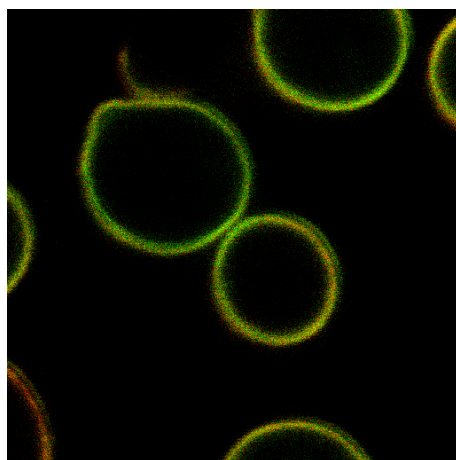


Figure: Encapsulated yeast cells, with 21 polyelectrolyte layers. 3rd and 19th one was labelled with FITC covalently bound to the polycation, 21st was labelled with Alexa(555) as well bound to the polycation.

- 1 Decher G. *Science* 277 (1997) 1232.
- 2 Möhwald H. *Coll. Surf. A* 171 (2000) 25.
- 3 Caruso F., Caruso R. A. and Möhwald H. *Science* 282 (1998) 1111.
- 4 Balabushevitch N. G., et al. *Biotechnol Bioeng.* 76 (2001) 207.
- 5 A. Diaspro, et al. *Langmuir* 18 (2002) 5047.
- 6 Moya S., et al. *Coll. Surf. A* 183–185 (2001) 27.
- 7 Soon-Shiong P. *Adv. Drug Delivery Rev.* 35 (1999) 259.
- 8 A. A. Antipov, et al. *Coll. Surf. A* 198-200 (2002) 535.
- 9 A. Diaspro, et al. *J. Phys. Chem. B.* 107 (2003) 11008.