Plant Virus Drug Delivery

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Tobacco Mosaic Virus is a tubular plant virus containing RNA and 2100 identical coat proteins. Our aim is filling up the 4nm wide and 300nm long channel of TMV with a cytostatic drug (e.g. otherwise highly toxic Pt compounds such as Cisplatin) and sealing the TMV ends by magnetic nanoparticles. The administration involves application of an alternating external magnetic field to break the seal to release the drug, as well as to generate heat, for simultaneous drug and hyperthermia treatment [1].

The Tobacco mosaic virus (TMV) can be metallized in aqueous suspension, resulting in unique dumbbell-, rod- and tube-shaped deposits with diameters down to 3 nm and lengths up to micrometers [2, 3]. The coating process is based on the adsorption of noble metal cations followed by autocatalytic electroless deposition (figure 1). Magnetometry measurements performed on these TMV samples (metallized with Ni) find a saturation magnetization of approximately 0.004 emu per gram of deposited solid (which contains Ni but also salts from the bath). This very low value can be accounted for by a cluster microstructure consisting of rather small Ni cores surrounded by NiO shells, which would be indicative of extensive oxidation. However, the measured coercivity of 90 Oe is similar to that of bulk Ni (100 Oe), suggesting that the cores are large enough to exhibit bulk ferromagnetism (figure 2). Previous work with TMV electroless deposition [3] showed that using the anionic surfactant Re-610/E makes Ni dots deposition only at ends of the TMV (figure 3). This was the basis for sealing the 4nm channel.

References

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[3] Z. Wu, R. Zierold, A. Müller, E. Ruff, C. Ma, Abid A. Khan, F. Geiger, M. Knez, K. Nielsch, Alexander M. Bittner, C. Wege and Carl E. Krill III. ***Submitted***.

Figures

Figure 1: Ni deposited on TMV via electroless deposition

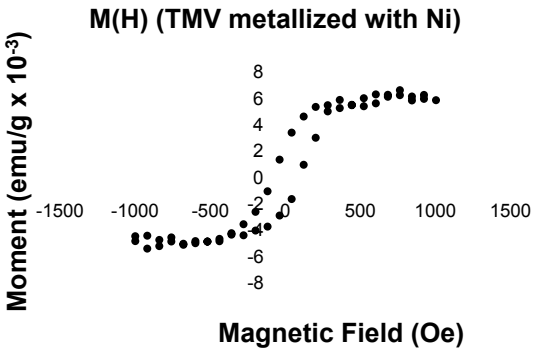

Figure 2: Magnetization of Ni deposited on TMV

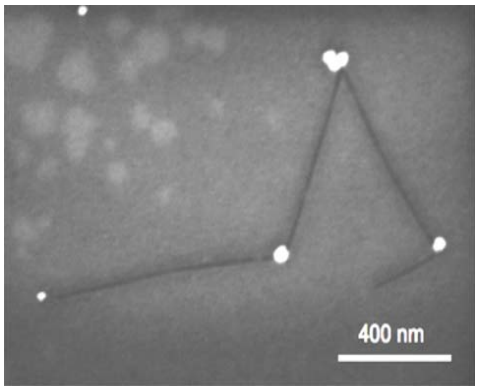

Figure 3: Ni-TMV-Ni dumbbells synthesized using Re-610/E in electroless depostion bath