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Influence of Aging on the Structure and Magnetic Properties of Surface Deposited Single-molecule Magnets

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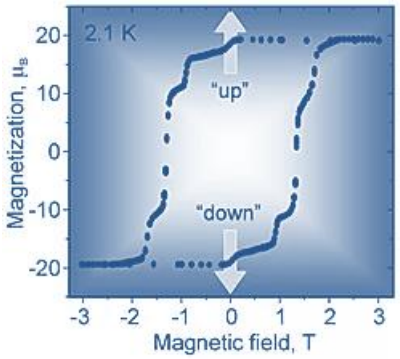
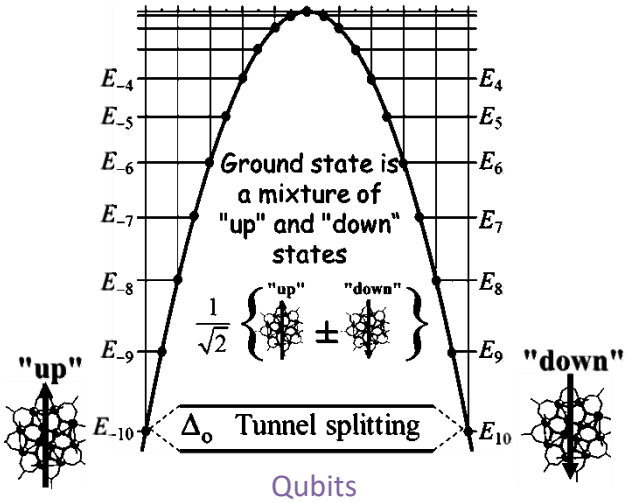
Application of materials based on the single molecule magnets



Magnetic memory of extremely high density

Mannini, M. et. al., **2009**, Nature Materials, 8(3), 194–197.

Quantum computers

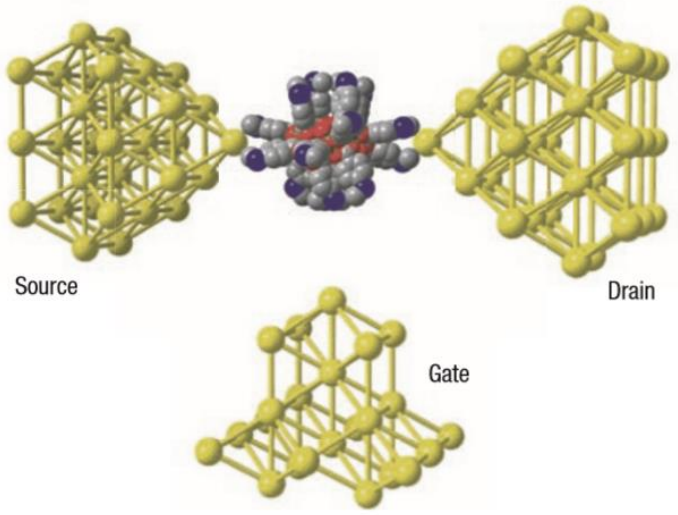


Qubits

M. N. Leuenberger, D. Loss, Nature **2001**, 410, 789.

SMMs

Molecular spintronics



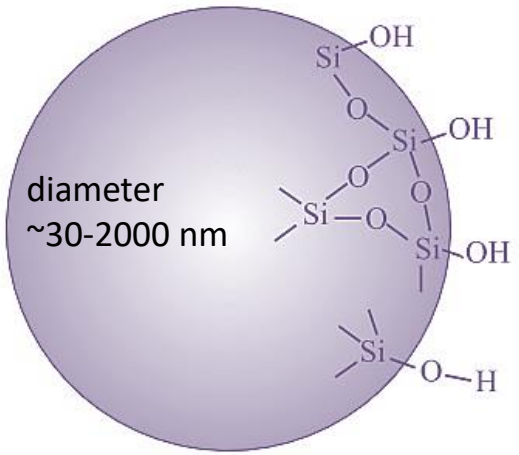
L. Bogdani, W. Wernsdorfer, Nature Materials **2008**, 7(3), 179-186

Deposition and separation of molecules on the surface of silica nanostructures

Nanocomposite materials based on silica

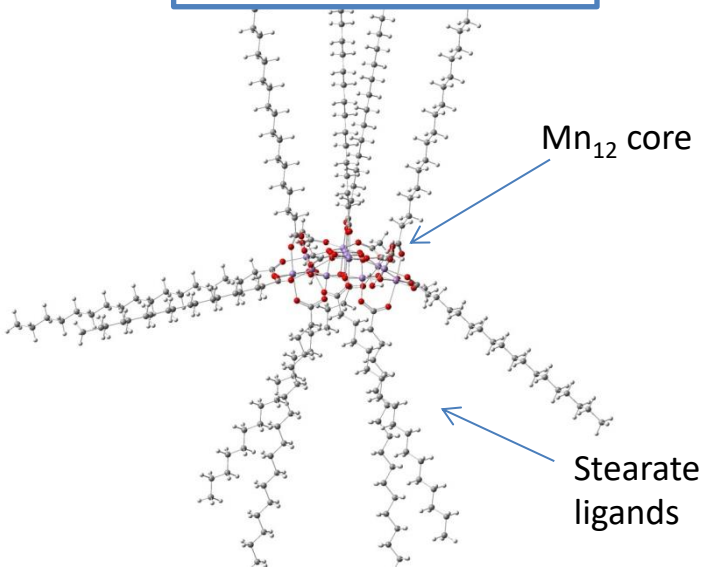
Substrate

Spherical silica nanoparticles

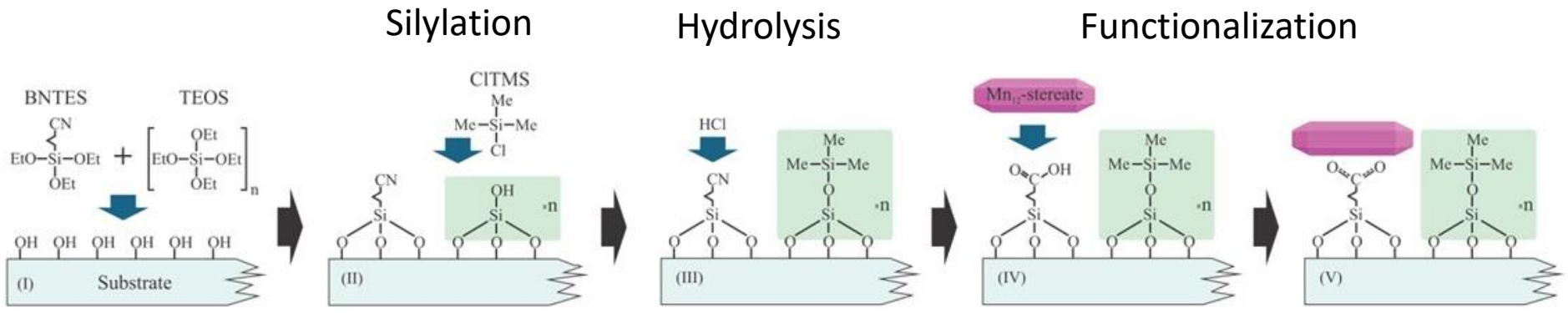


Single molecule magnets

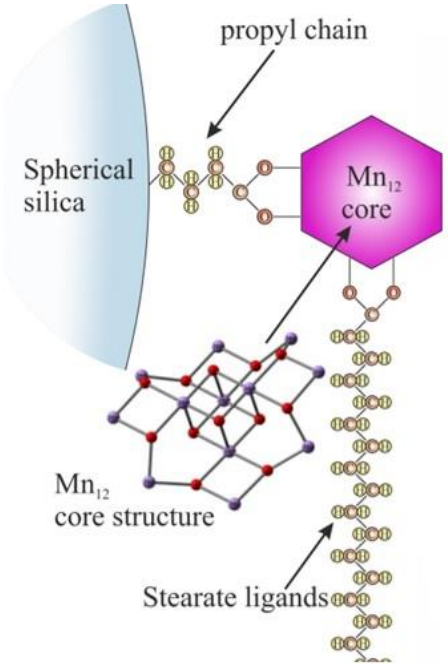
Mn_{12}-stearate



Synthesis route



Resulted material

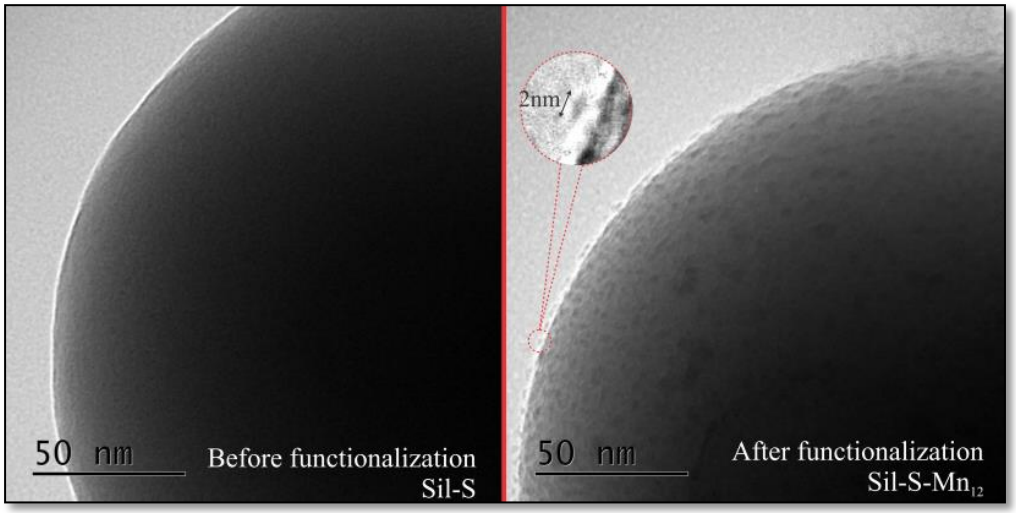


For synthesis details see:

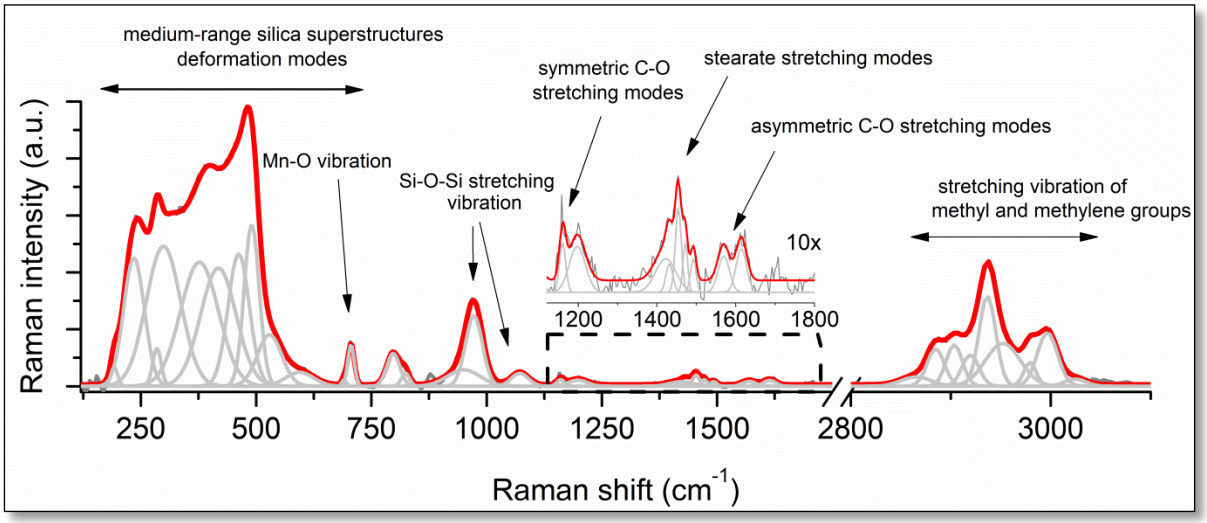
Laskowski, L.; Kityk, I.; Konieczny, P.; Pastukh, O.; Schabikowski, M.; Laskowska, M. (2019) *Nanomaterials*. **9**. 764.

Morphological and structural measurements

TEM microscopy



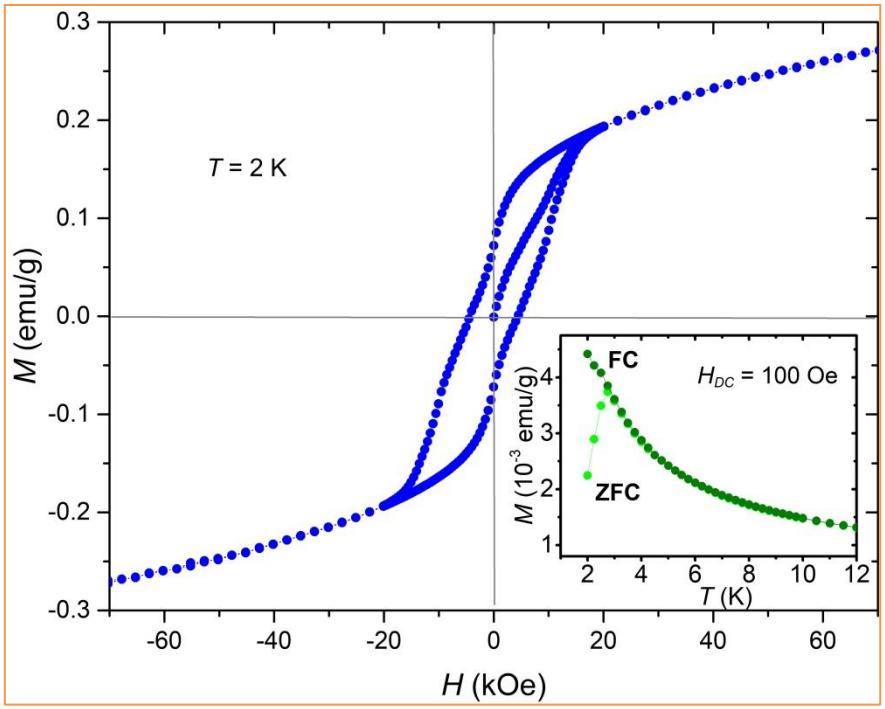
Raman spectroscopy



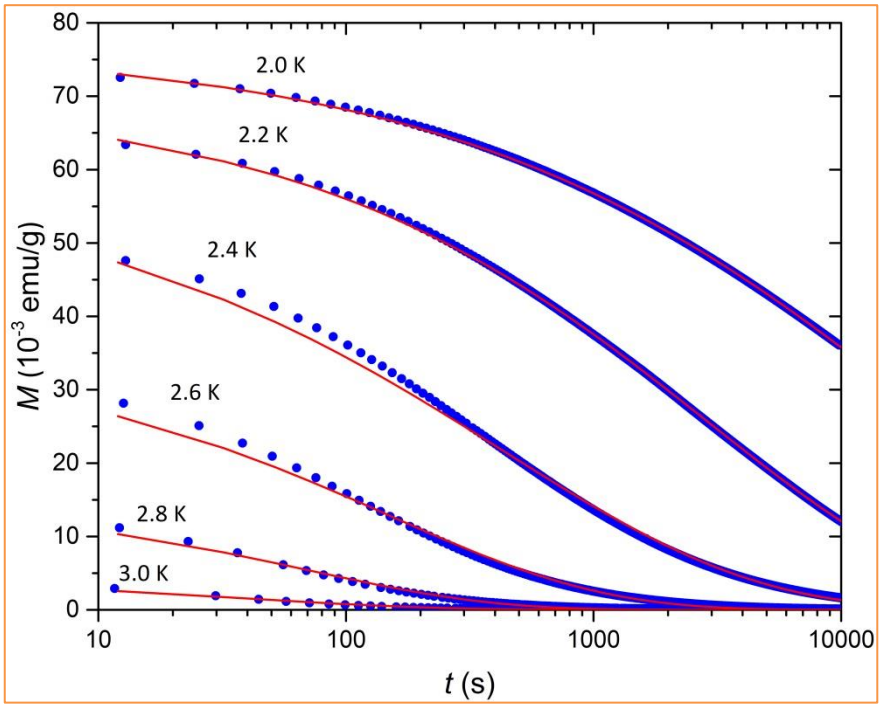
Laskowski, L.; Kityk, I.; Konieczny, P.; Pastukh, O.; Schabikowski, M.; Laskowska, M. (2019) *Nanomaterials.* **9**. 764.

Magnetic measurements

SQUID magnetometry



Isothermal magnetization at 2.0 K. Inset: ZFC (light green) and FC (dark green) magnetic susceptibilities of sample measured at H = 100 Oe (lines are guide for the eye)



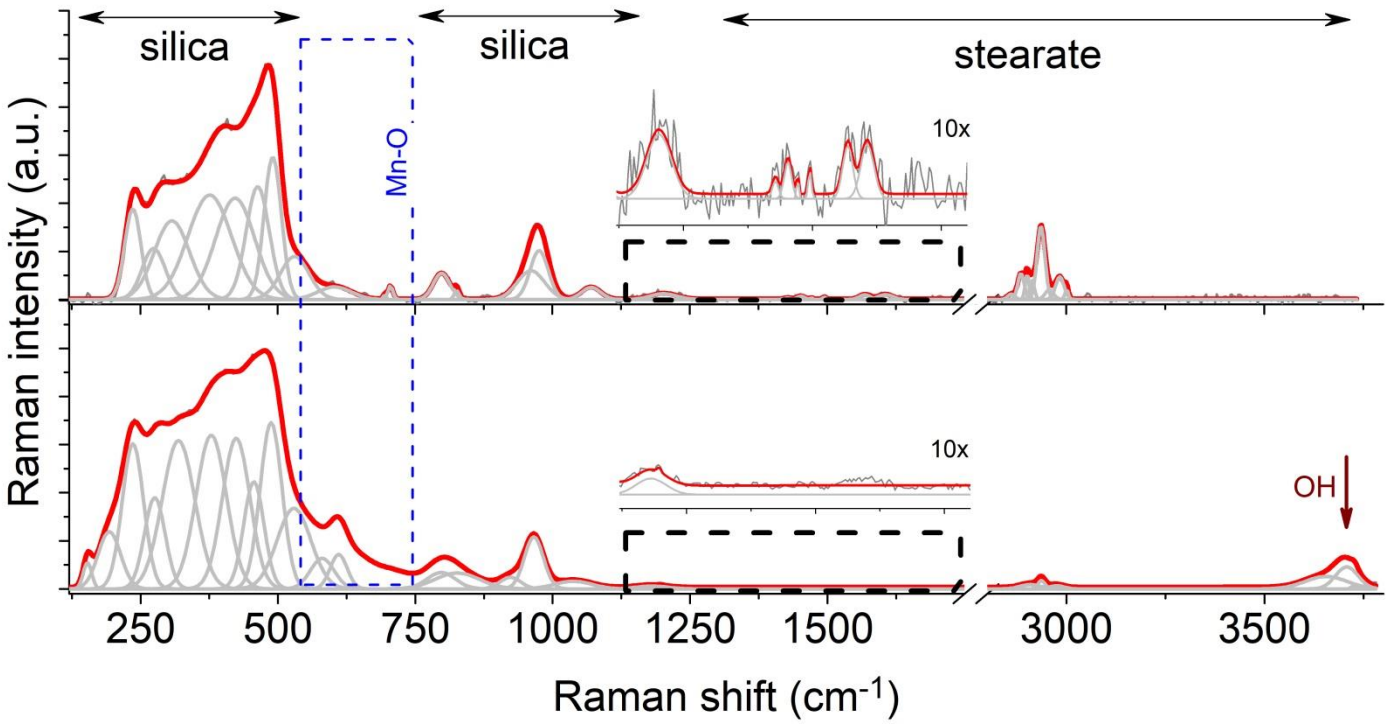
Time dependence of magnetization for sample at 2 – 3 K. The solid lines are the best fits to the stretched exponential function*. The fit of relaxation time to the Arrhenius law reveales value of effective energy barrier of 33.6 K.

*For details see:

Laskowska, M., Pastukh, O., Konieczny, P., Dulski, M., Zalsiński, M., & Laskowski, L. (2020). *Materials*. **13**. 2624.

Aging effect on the structure

Raman spectroscopy



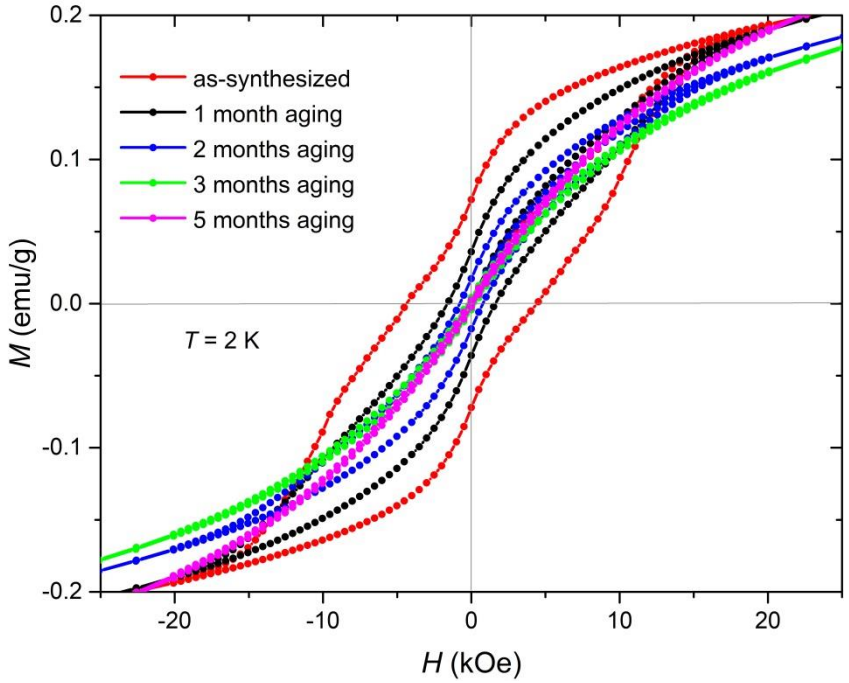
As-synthesized sample

5 months aged sample

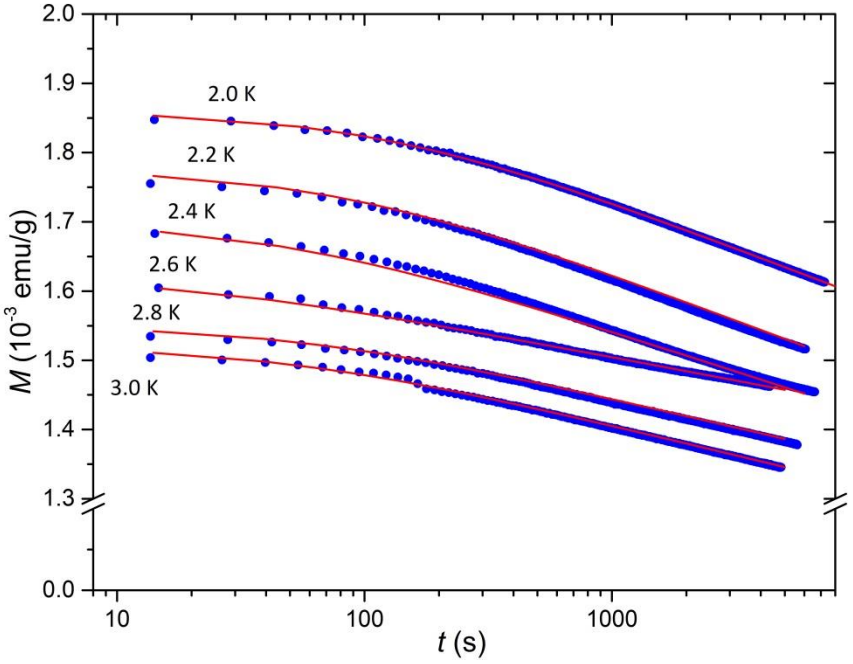
Oleksandr Pastukh, Piotr Konieczny, Dominik Czernia, Magdalena Laskowska, Mateusz Dulski, Łukasz Laskowski. (2020). *Materials Science & Engineering B.* **261**. 114670.

Aging effect on the magnetic properties

SQUID magnetometry



Isothermal magnetization at 2.0 K for sample during the aging



Time dependence of magnetization of the 5 month aged sample at various temperatures. The solid lines are the best fits to the magnetic viscosity function*

*For details see:

Oleksandr Pastukh, Piotr Konieczny, Dominik Czernia, Magdalena Laskowska, Mateusz Dulski, Łukasz Laskowski. (2020). *Materials Science & Engineering B.* **261**. 114670.

Summary

- There is a possibility for deposition of Mn_{12}-stearate SMMs on the surface of spherical silica nanoparticles
- Deposited molecules preserve its structure and magnetic properties
- Aging effect on the magnetic properties reveal significant decrease in basic magnetic parameters and change in magnetic relaxation behavior

Thank you for your attention!

Acknowledgments

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