International Conference
on the Applications of the Mössbauer Effect

ICAME 2017

Saint-Peterburg, Russia
3-8 September 2017

Conference Programme
Dynamics of Ternary Cu-Fe-S\textsubscript{2} Nanoparticles Stabilized by Organic Ligands

Ruebenbauer K.\textsuperscript{2}, Żukrowski J.\textsuperscript{1}, Błachowski A.\textsuperscript{2}, Komędera K.\textsuperscript{2}, Pierzga A.\textsuperscript{2}, Gąbka G.\textsuperscript{3}, Bujak P.\textsuperscript{3}, Proń A.\textsuperscript{3}, Przybylski M.\textsuperscript{1,4}

1 - Academic Centre for Materials and Nanotechnology, AGH University of Science and Technology, PL-30-059 Kraków, Av. A. Mickiewicza 30, Poland
2 - Mössbauer Spectroscopy Division, Institute of Physics, Pedagogical University, PL-30-084 Kraków, ul. Podchorążych 2, Poland
3 - Faculty of Chemistry, Warsaw University of Technology, PL-00-664 Warsaw, ul. Noakowskiego 3, Poland
4 - Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, PL-30-059 Kraków, Av. A. Mickiewicza 30, Poland

sfrueben@cyf-kr.edu.pl

Chalcopyrite-type (Cu-Fe-S\textsubscript{2}) ternary nanocrystals stabilized by long aliphatic chain ligands could be considered as isolated hard nano-objects dispersed in soft network of organic ligands. The main attention was paid to the behavior of the particles whose average size was varied in a controllable manner from 3 to 20 nm. Dynamics of nanoparticles was studied by applying Mössbauer spectroscopy. The fast dynamics could be described by two-level environment. Deeper level (atomic) was practically the same as for bulk material except Debye temperature, but the higher level (particle motion) was described by the classical harmonic oscillator with the spring constant dramatically softening with increasing temperature. Such behavior led to fast decrease of the fraction detectable by Mössbauer spectroscopy with increasing temperature. The induced internal oscillations within particle by surrounding thermal bath additionally contribute to the shift of measured spectra. Slow dynamics was characterized by the thermally driven overdamped harmonic oscillator motions. In addition, the long range-like diffusion of particles was seen. No significant rotation of particles was found within accessible temperature range [1].

References