

Reanalysis of Multichannel Field-Induced Magnetic Relaxation in a Selected Series of Co(II) Complexes

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Rok wydania

2026

Czasopismo

Magnetochemistry

Numer woluminu

12

Strony

109/1-109/44

DOI

10.3390/magnetochemistry12100109

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

This study investigates field-supported slow relaxation of magnetization in 48 diverse Co(II) compounds, encompassing 0D, 1D, and 2D systems with coordination numbers 4, 5, and 6. Using AC susceptometry, out-of-phase susceptibility (χ'') was analyzed as a function of frequency, temperature, and DC field. Deconvolution via an extended Debye model reveals three distinct relaxation components: low-frequency ($\tau_{LF} \approx 1$ s), intermediate-frequency ($\tau_{IF} \approx 1$ ms), and high-frequency ($\tau_{HF} \approx 1$ μ s) modes. While most complexes follow standard thermal behavior, the research highlights anomalous reciprocating thermal behavior (RTB), where relaxation times unexpectedly shorten upon cooling. By utilizing $\ln(\tau)$ vs. $\ln(T)$ plots, the study points to relaxation mechanisms based on the power law expressed as $1/\tau = CT^n$, including Raman (typically $n = 5-9$), direct ($n = 1$, field dependent), phonon bottleneck ($n = 2$), RTB ($n = -1$), Orbach (possibly $n > 9$), and quantum tunneling ($n = 0$) processes. Findings indicate that the Orbach mechanism is less common than traditionally assumed and that the retrieved experimental barrier (U_{eff}) is often a fictitious parameter. This study provides a critical reanalysis of the magnetic properties of a selected set of Co(II) complexes, with focus on slow magnetic relaxation.

Słowa kluczowe

Co(II) complexes, slow magnetic relaxation, AC susceptibility, relaxation mechanisms

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Adres publiczny

<http://dx.doi.org/10.3390/magnetochemistry12100109>

Strona internetowa wydawcy

<http://www.mdpi.com/journal/metals>