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磁性纳米颗粒系统的铁磁共振和共振线宽分析

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The analysis of the ferromagnetic resonance and linewidth of resonance on magnetic nanoparticle system

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全文: PDF (1224 KB) HTML (KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 对非相互作用磁性纳米颗粒系统的FMR线型模型进行了研究,以铁磁体从应用场中获得自由能F为例,导出磁性颗粒在较小各向异性时,共振场H_r与有效各向异性场H_A^{eff}的关系,这个结果与Raikher和Stepanou的结果一致.继而还对共振场线宽进行了分析,并与Smit和Beljers模型进行了比较,其结论说明:在超顺磁区域有效各向异性场H_A^{eff}对塞曼(Zeeman)相互作用和附加应用场H是不确定的.尤其是这种情况在H_A^{eff}较小、高温(高温区域),且$H_A^{eff}\approx H$时,变得更显著.为此提出了随机颗粒阵列及参数特征对这个结果的影响机制.

关键词: 磁性纳米颗粒 铁磁共振 共振线宽 磁各向异性

Abstract: The FMR line shape modeling of non-interacting magnetic nanoparticles system was studied.As an example:the ferromagnetic has obtained the free energy F from the system in the presence of an applied field,the relation between resonance field H_r and effective anisotropy field H_A^{eff} was educed.The results is in consonace with the research conclusion of Raikher and Stepanou etc.It has been analyzed the linewidth of resonance field and compared with the results of Smit and Beljers,and come to the conclusion that the effective anisotropy field H_A^{eff} in the superparamagnetic regime is considered as a perturbation to the Zeeman interaction and added to the applied field H.Especially,while the difference between these approaches is negligible for small H_A^{eff}(high temperature regime),it becomes more pronounced when $H_A^{eff}\approx H$.This article show how these results influence the determination of the parameters characterizing an array of random particles.

Key words: magnetic nanoparticles ferromagnetic resonance linewidth of resonance anisotropy of magnetic

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