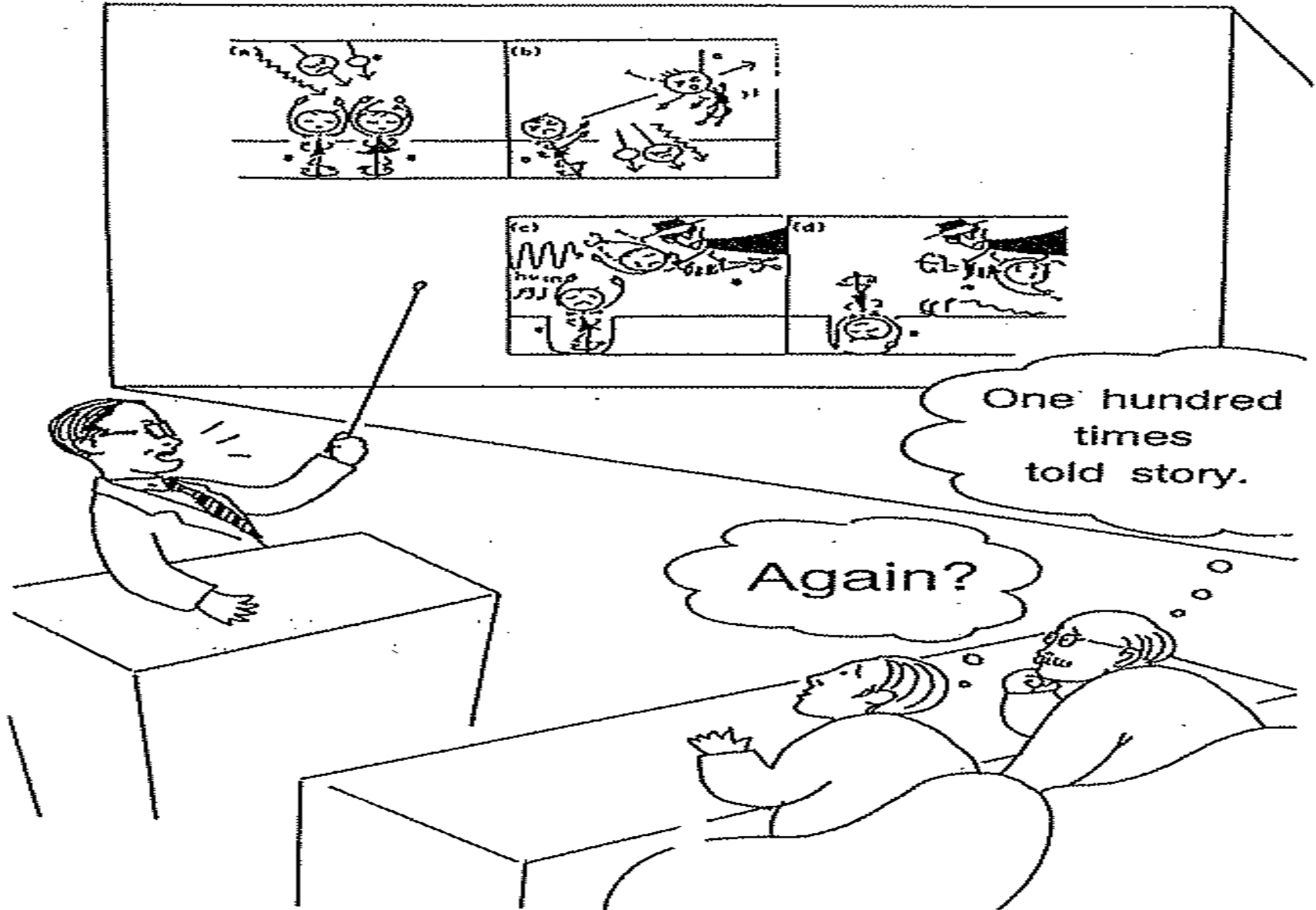
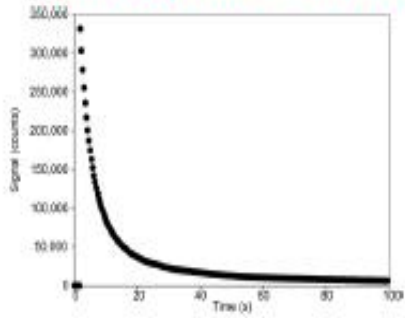


ESR Dating and Dosimetry

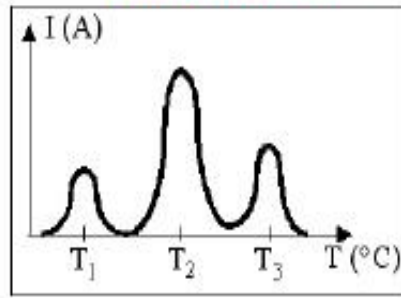
– Principles and Procedures –



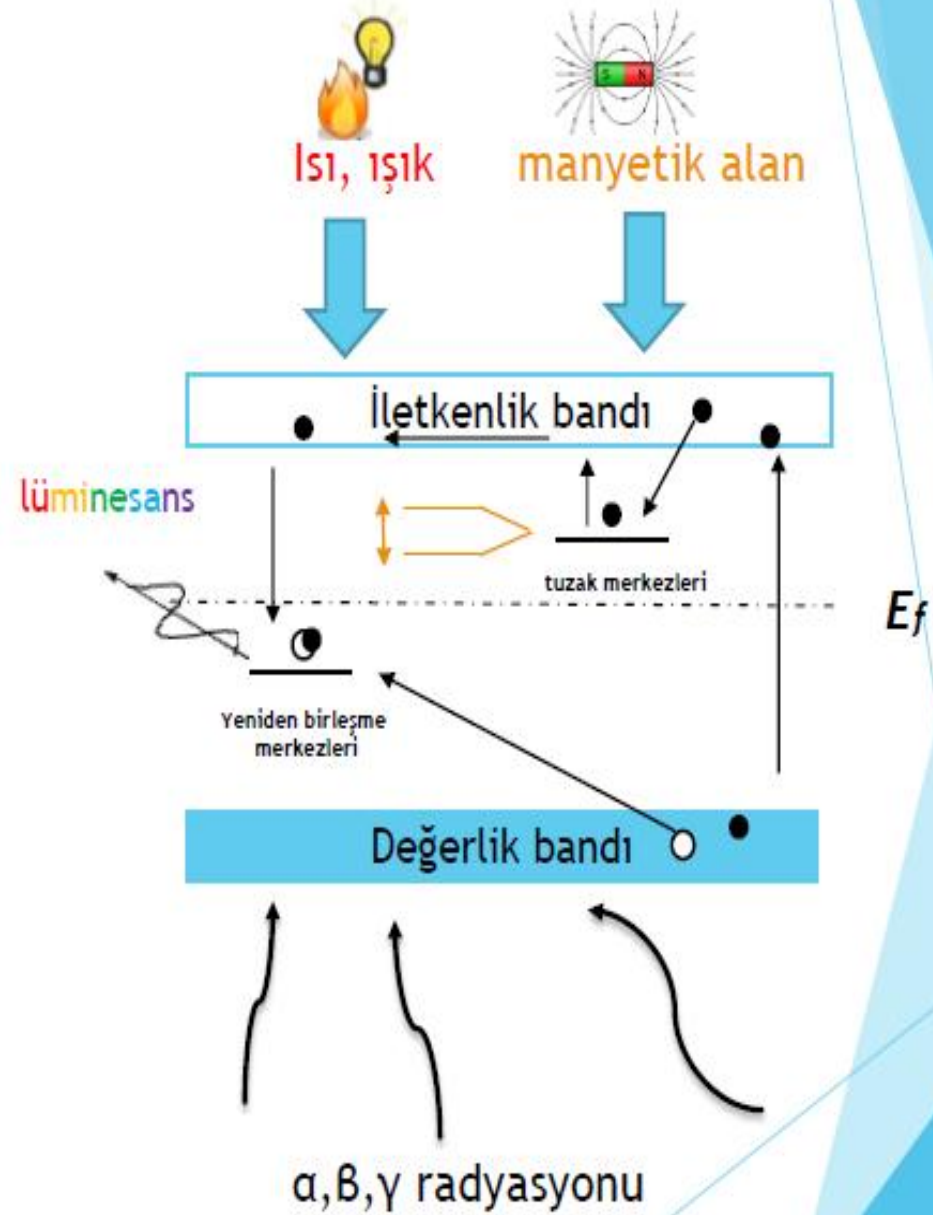
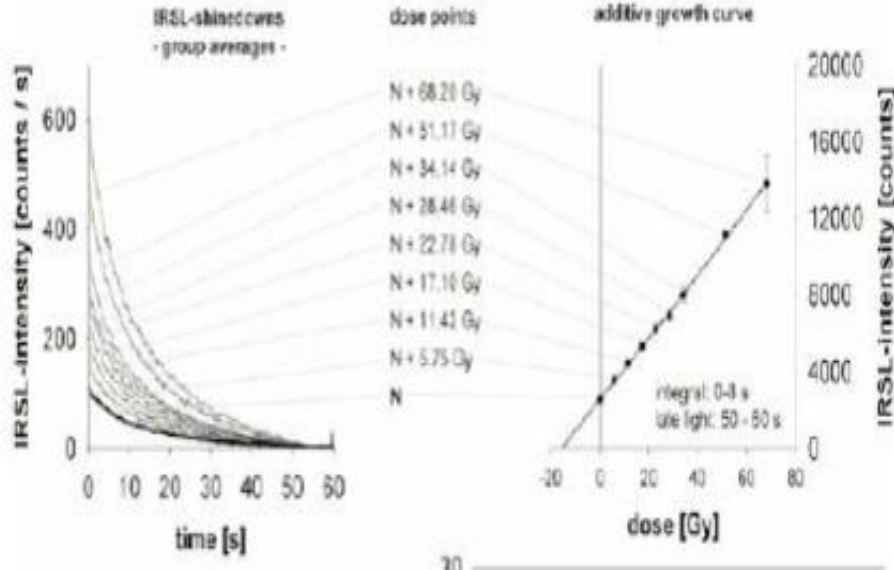
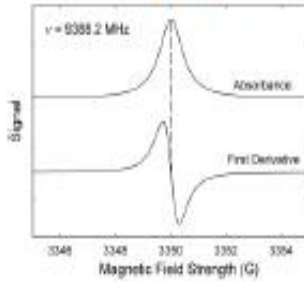
Optik Uyarmalı Lüminesans



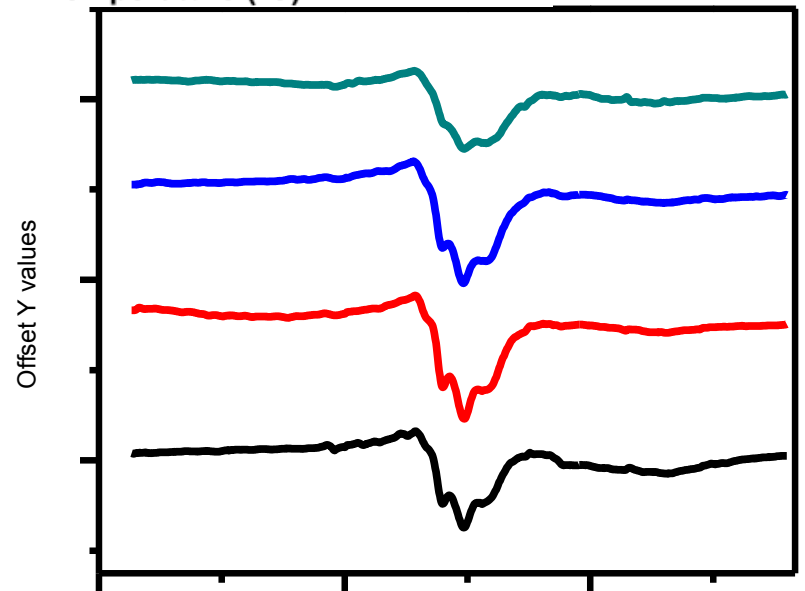
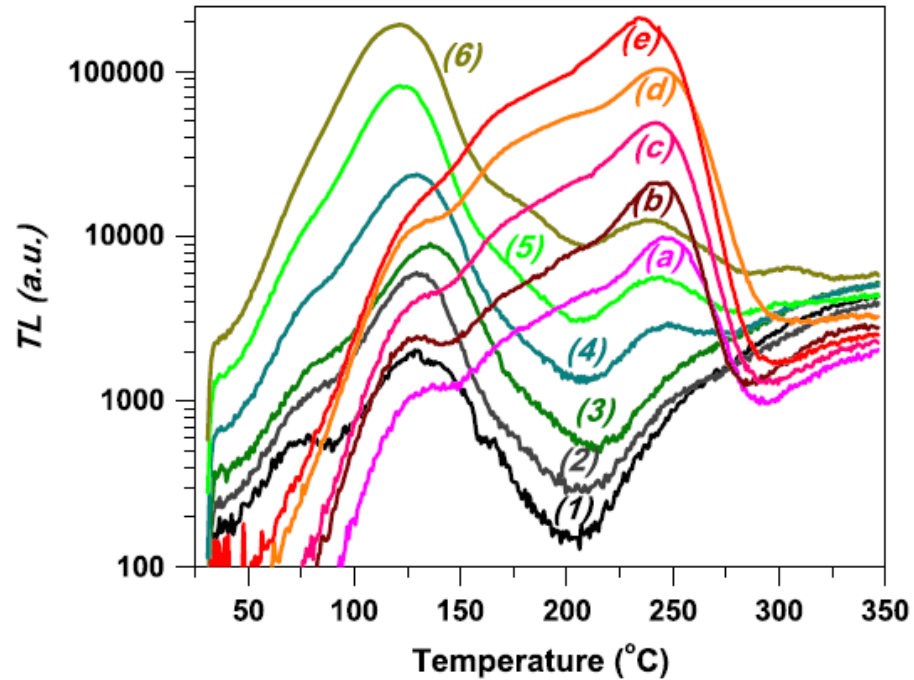
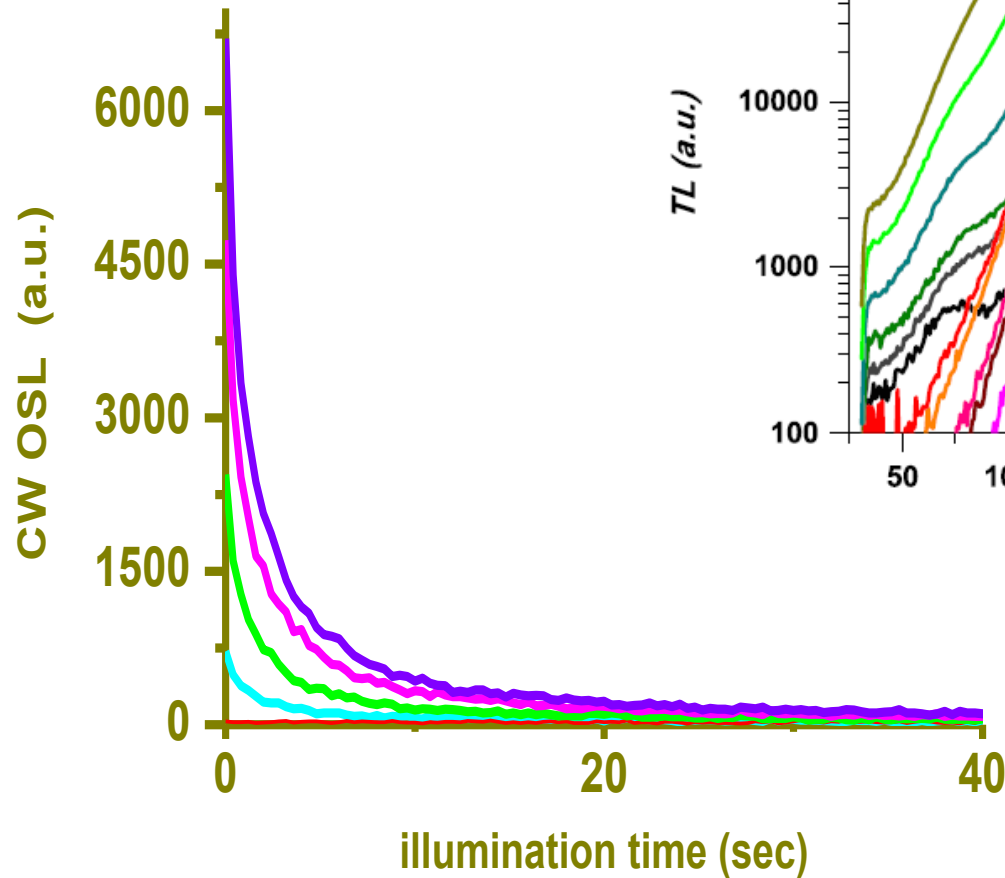
Termolüminesans



Elektron Spin (Paramagnetic) Rezonans



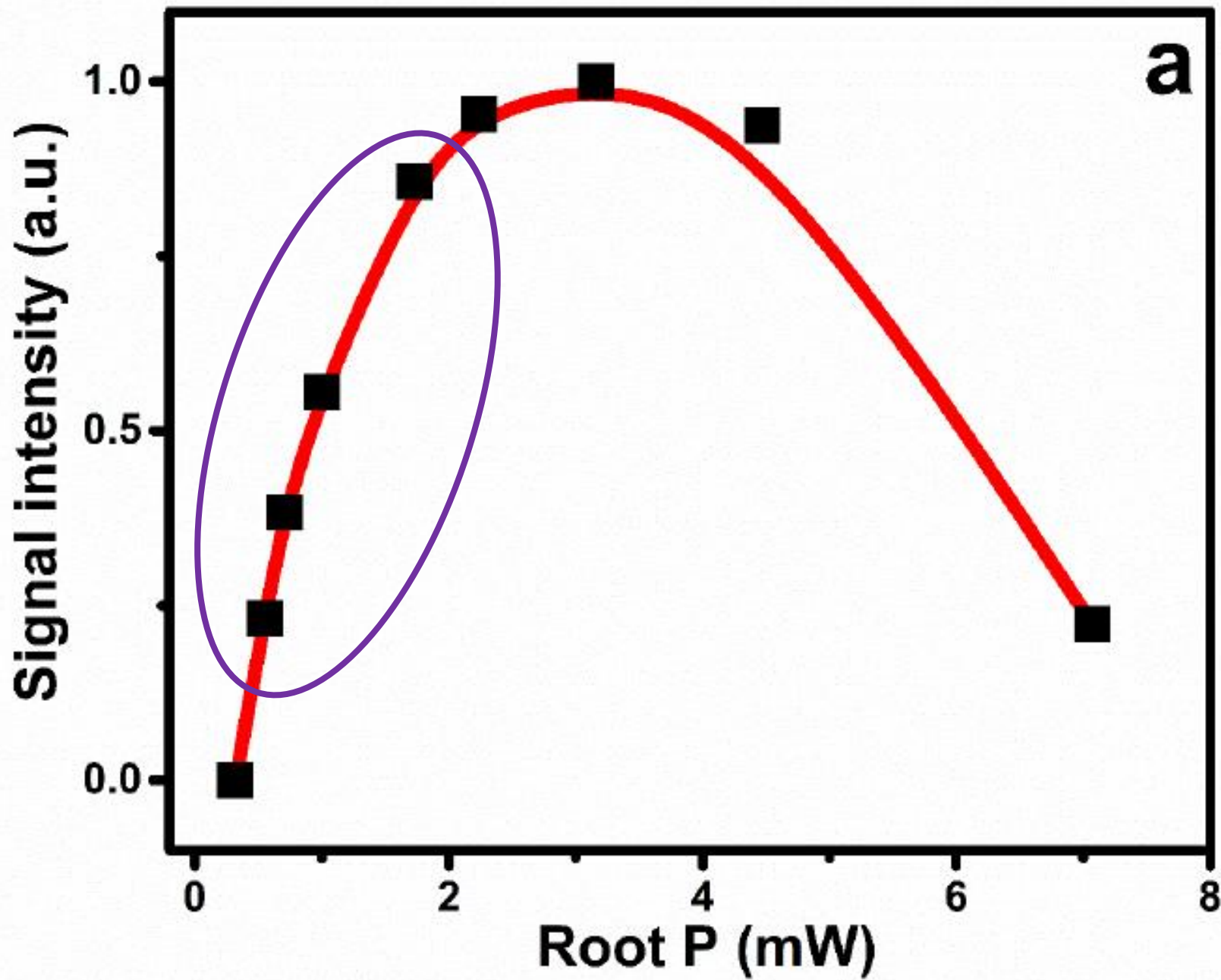
Examples of TL – OSL - ESR Curves



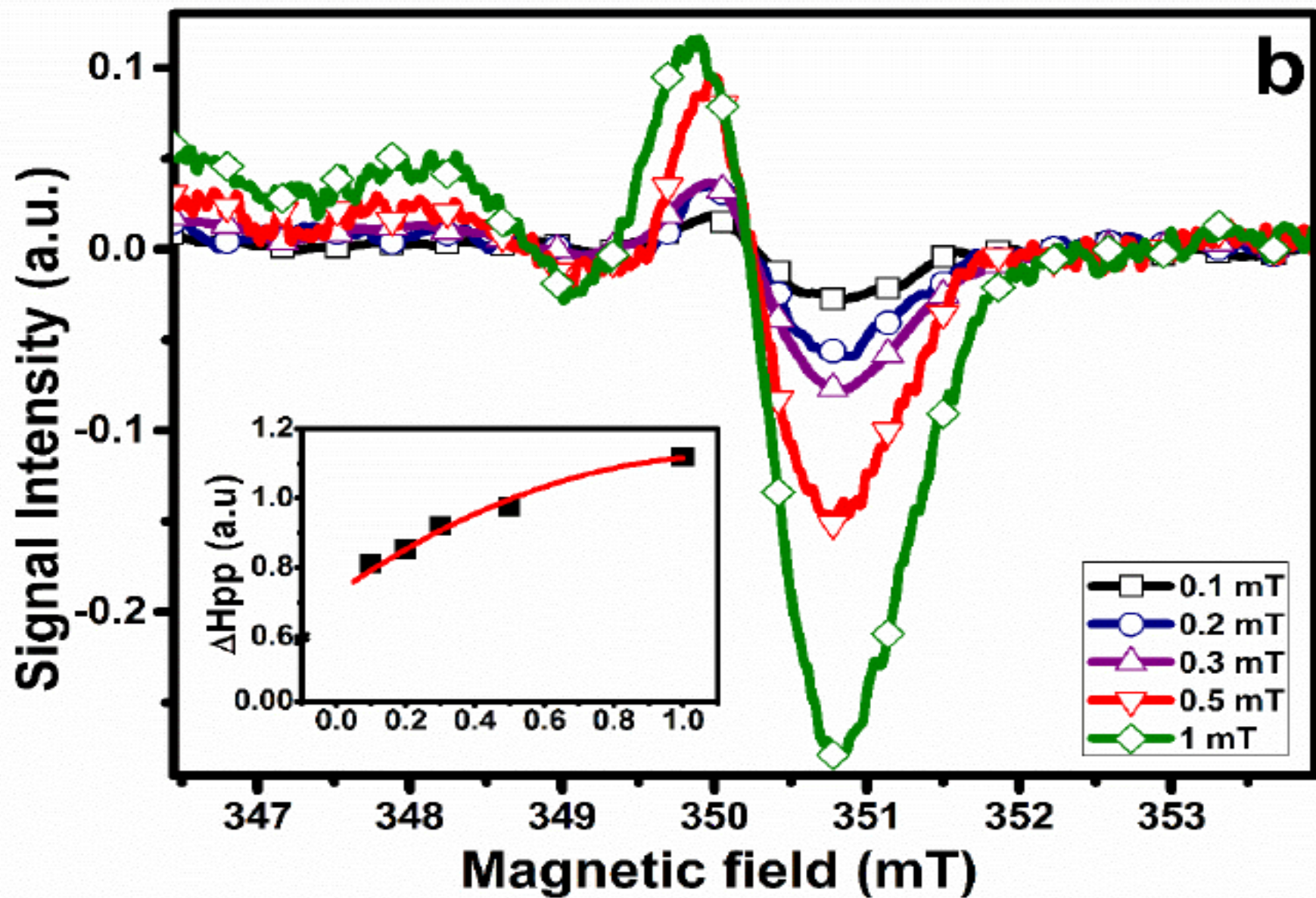
Measurement Parameters

Table 1. List of the ESR measurement parameters

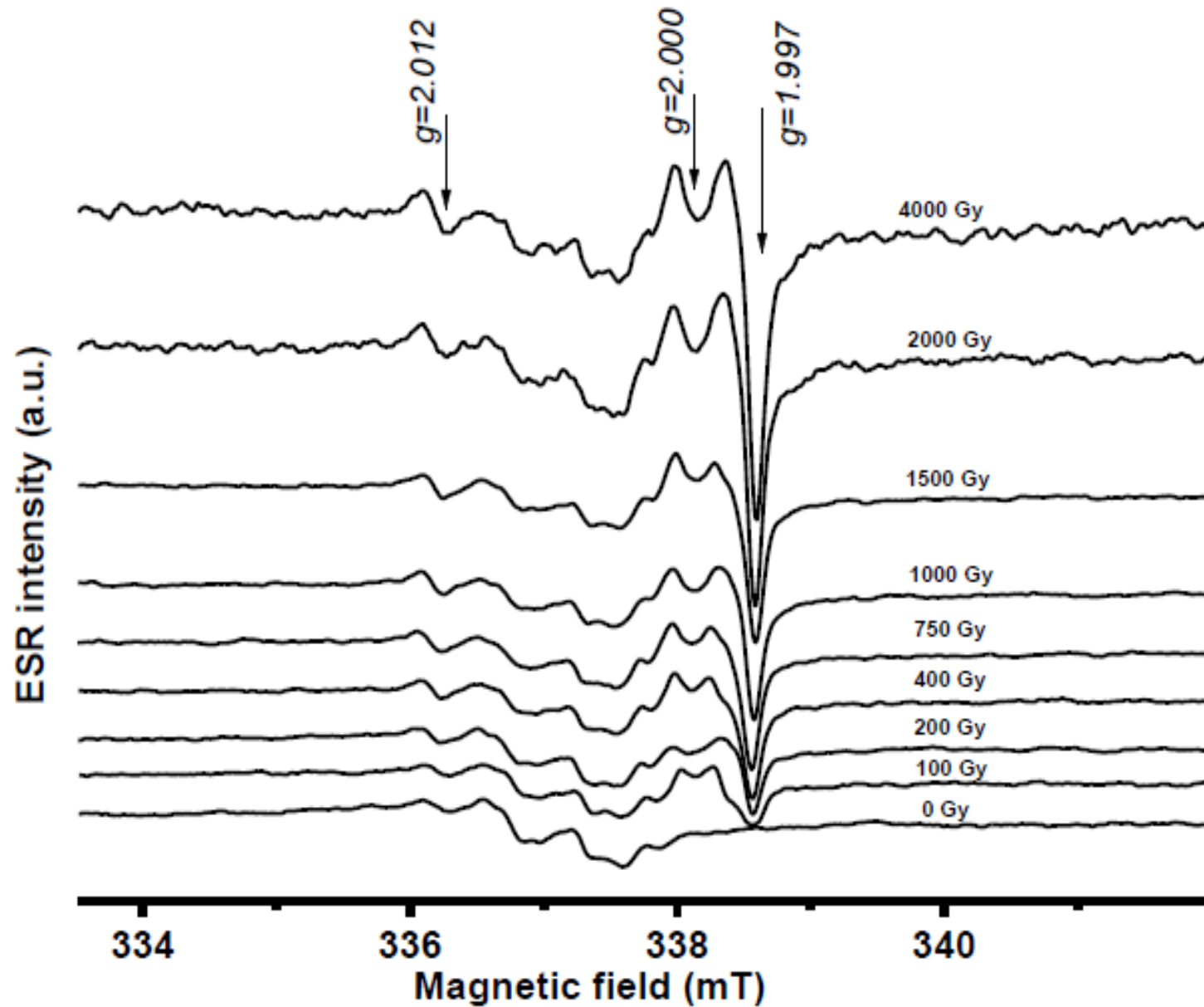
Microwave power (mW)	0.502
Modulation amplitude (mT)	0.3
Sweep width (mT)	10
Sweep time (s)	163.84
Conversion time (ms)	160
Number of scans	10
Microwave frequency (GHz)	~9.8
Sample mass (mg)	5-6
Number of points	1024



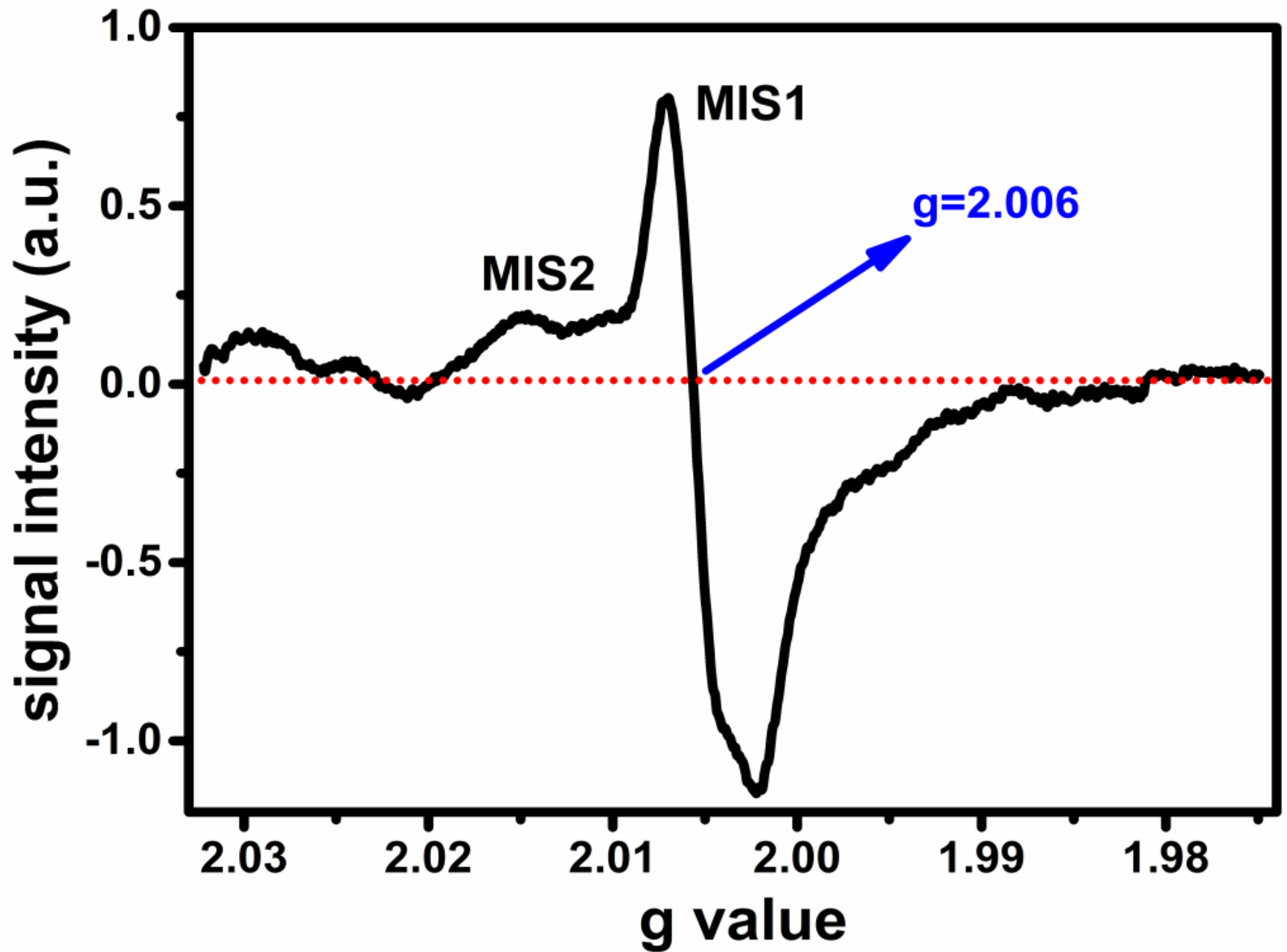
Nails



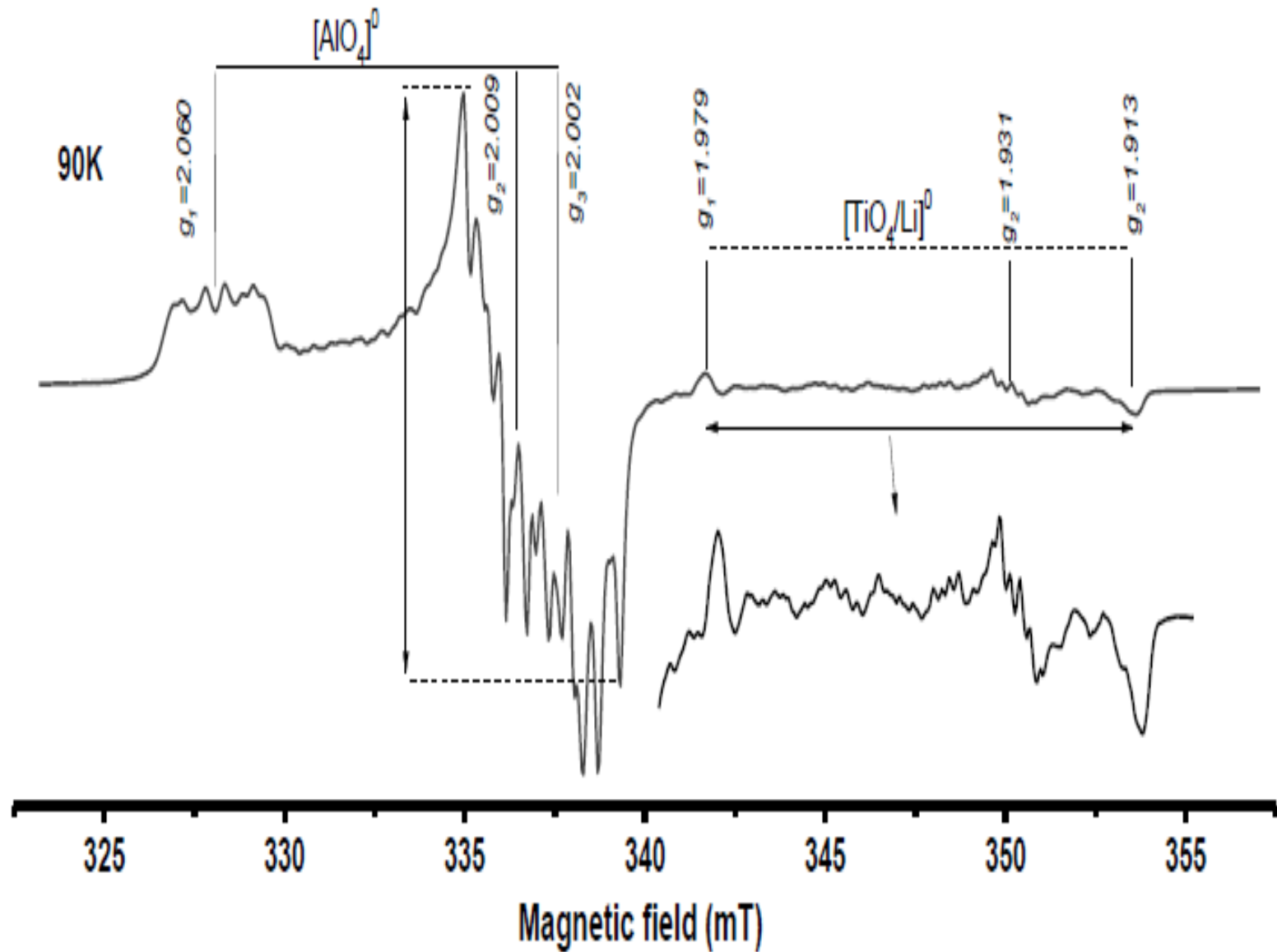
Quartz



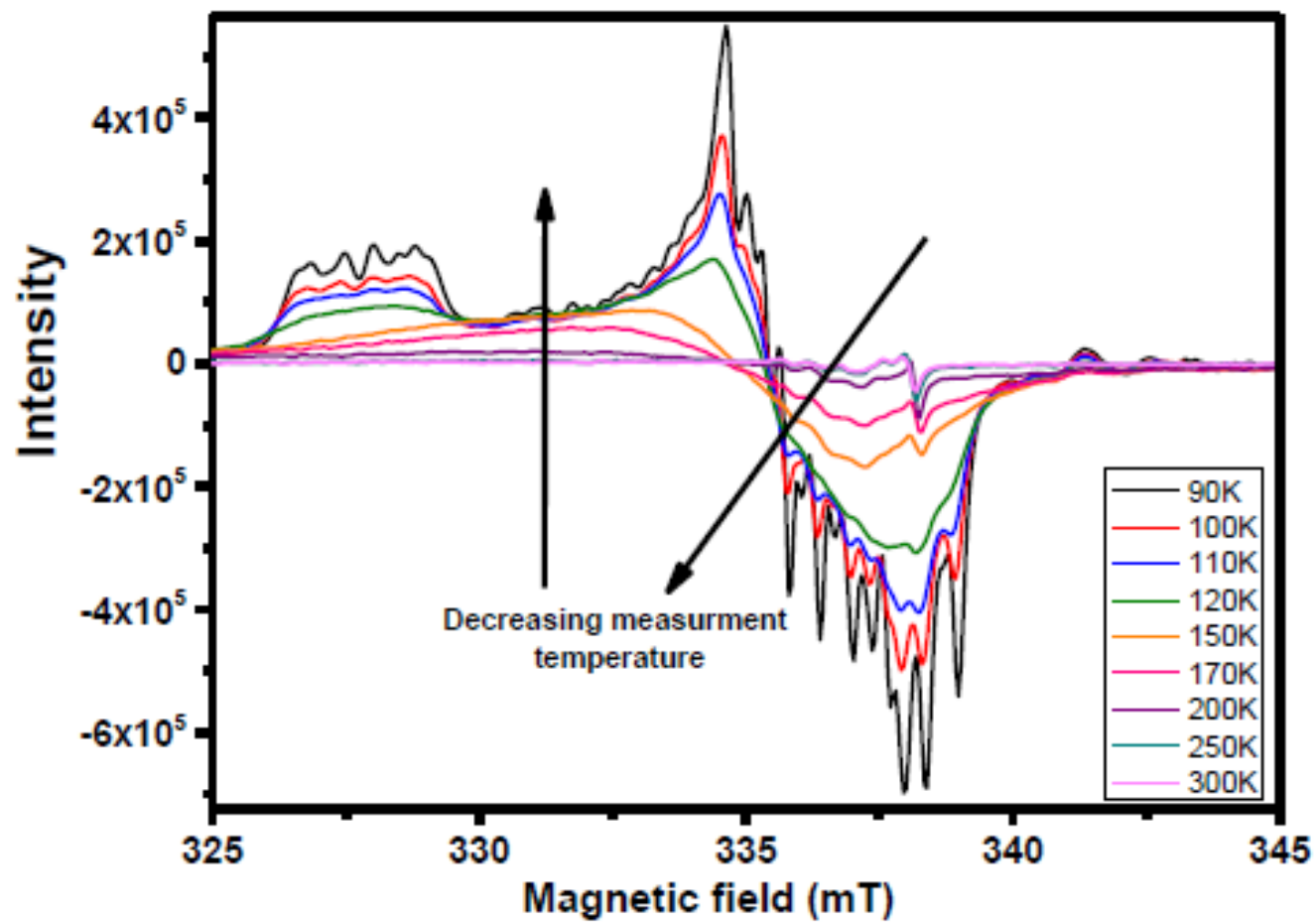
Nails



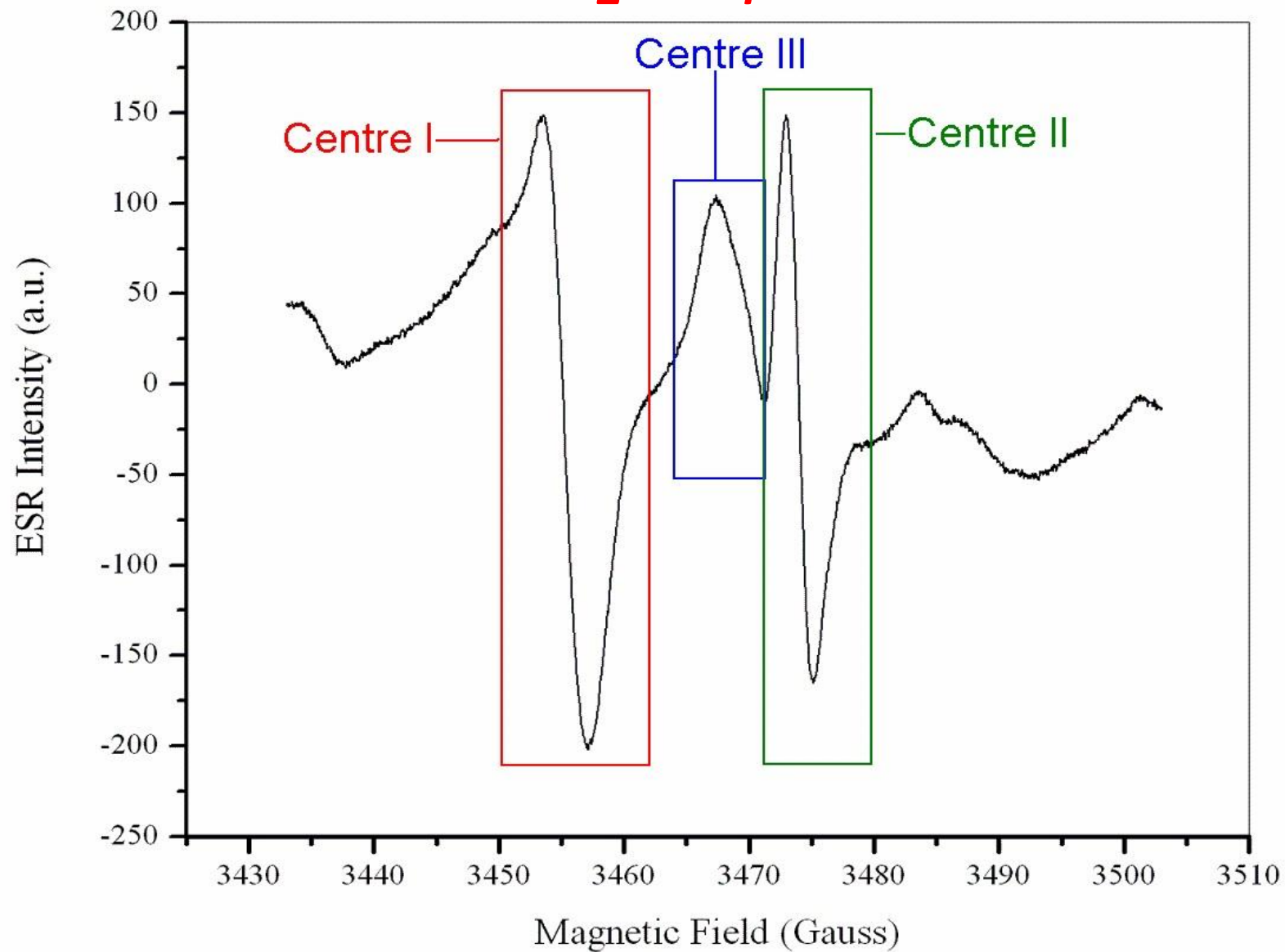
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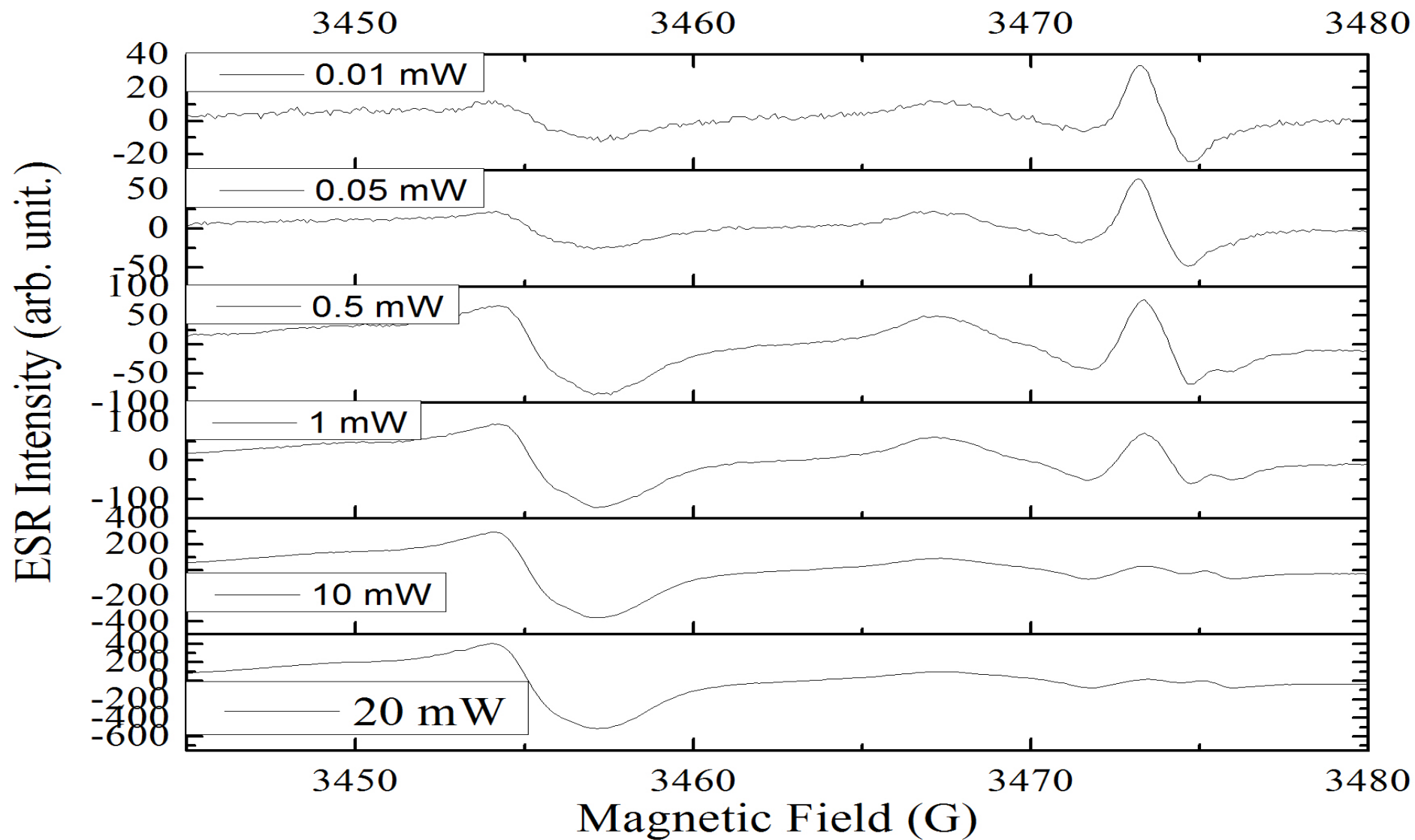
Low temperature measurements give a sharp linewidth, increase the spin population in the lower state due to Boltzmann factor, $e^{-g\beta H/k_B T}$ and so the signal to noise (S/N) ratio (about a factor of 4 increase by measuring at 77K). Freezing of water in a sample also reduces microwave power loss, which enhances the signal intensity. However, some signal intensity is saturated at low microwave power at a low temperature.



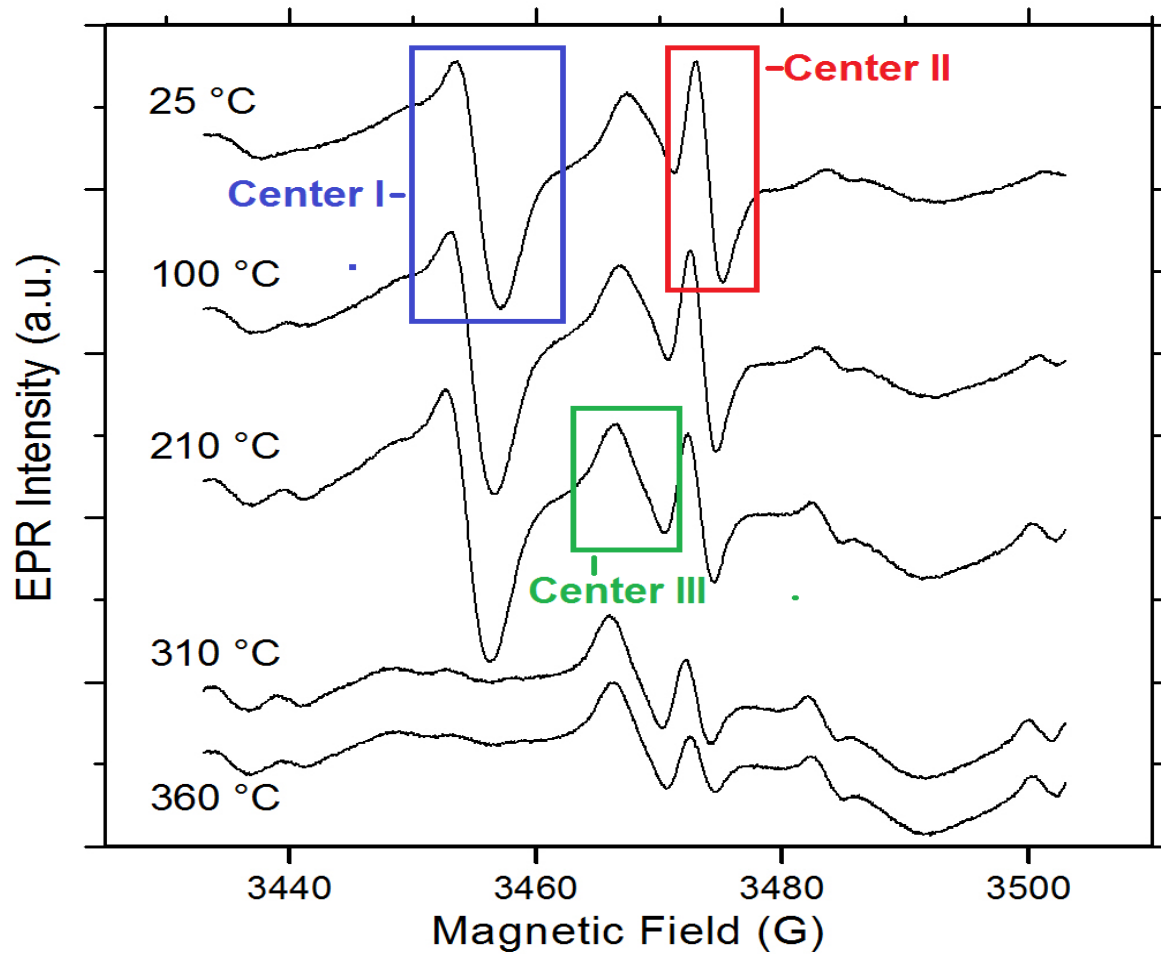
$Mg_2SiO_4:Tb$



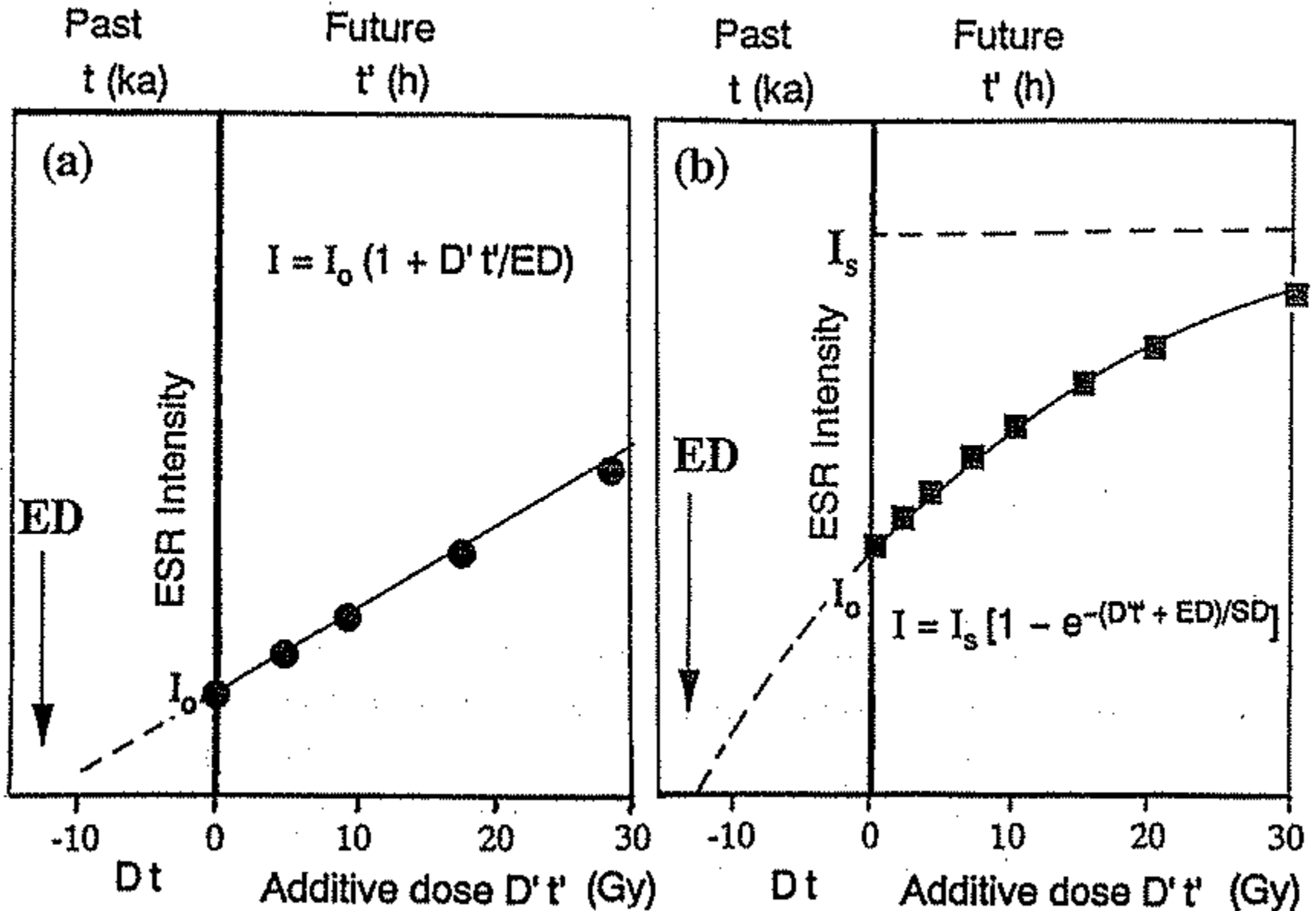
Mg₂SiO₄:Tb



$Mg_2SiO_4:Tb$



Additive Dose Procedure



Wait and See method

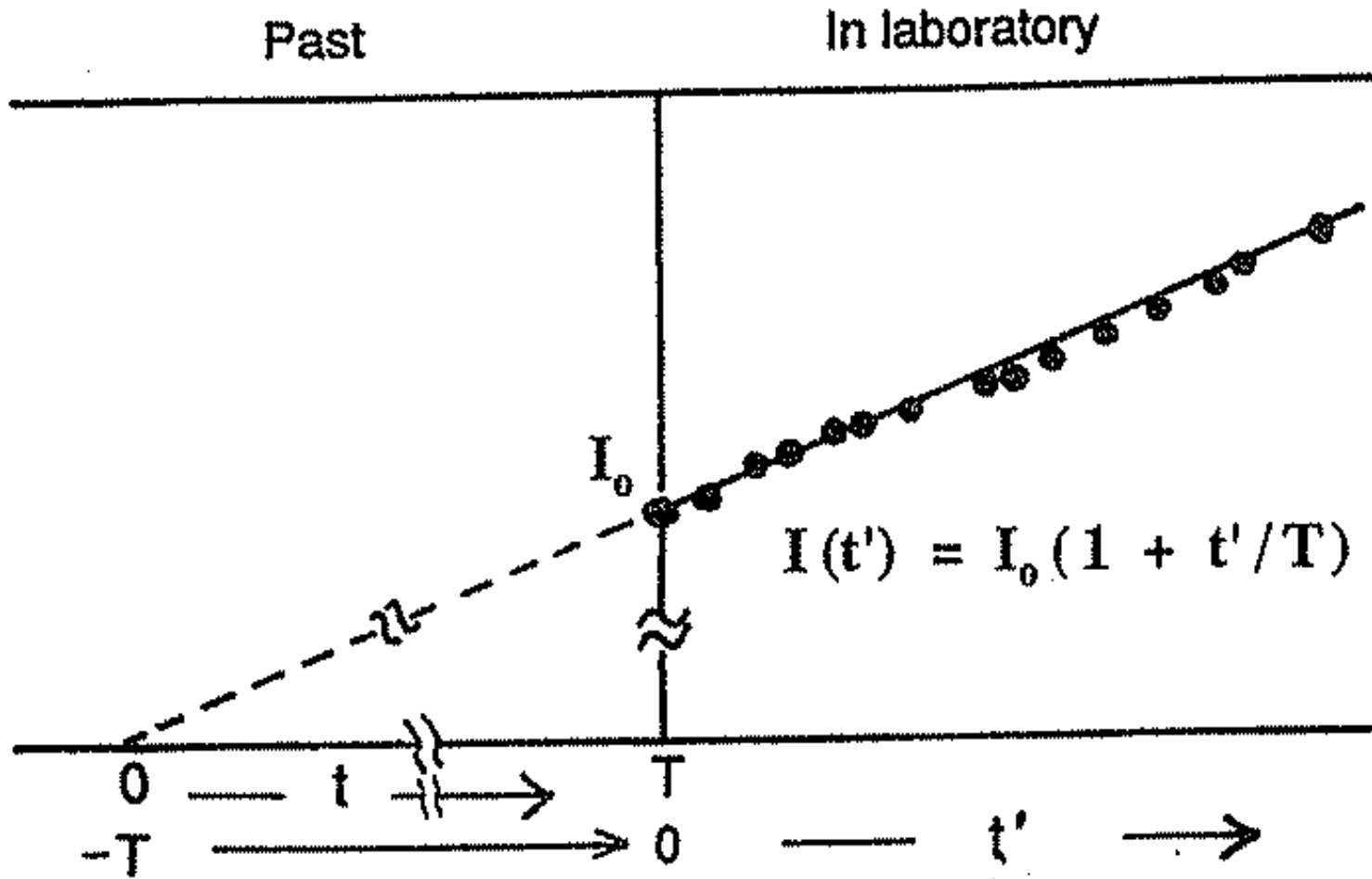


Table 3.1 Materials used for ESR dating and dosimetry.

Materials	Chemical Form	Applications
Carbonates	CaCO_3	stalactite, travertine spring deposit, etc.
Biocarbonates	CaCO_3	coral, shell, foraminifera egg shell, calcrete
Sulfates	CaSO_4 $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	anhydrite gypsum (desert deposit, cave deposit)
Bicarbonates	NaHCO_3	saline lake deposit
Phosphates	$\text{Ca}_5(\text{PO}_4)_3\text{X}$ CaHPO_4	hydroxyapatite, tooth, bone phosphate nodule
Silica	SiO_2	geological fault volcanic rock, altered rock
Silicates	ZrSiO_4	zircon feldspars, clay minerals
Ice & Dry Ice	H_2O , CO_2	comet, solid H_2O and CO_2
Organics	radicals * radicals metal ions *	food, crop, leather, paper alanine, sugar mummy, blood