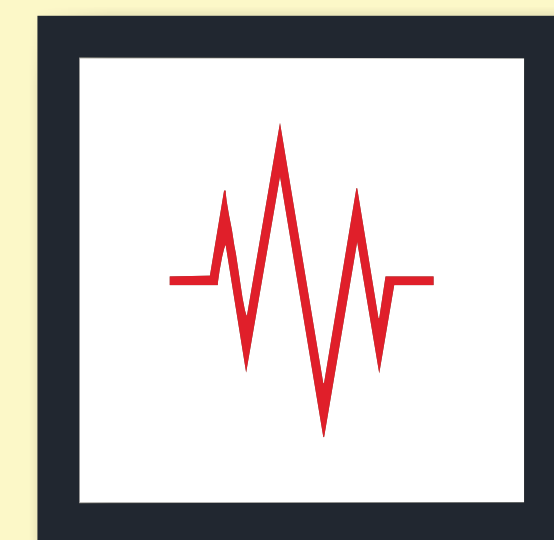




# Ageing effect in nanocrystalline TiC/C studied by EPR



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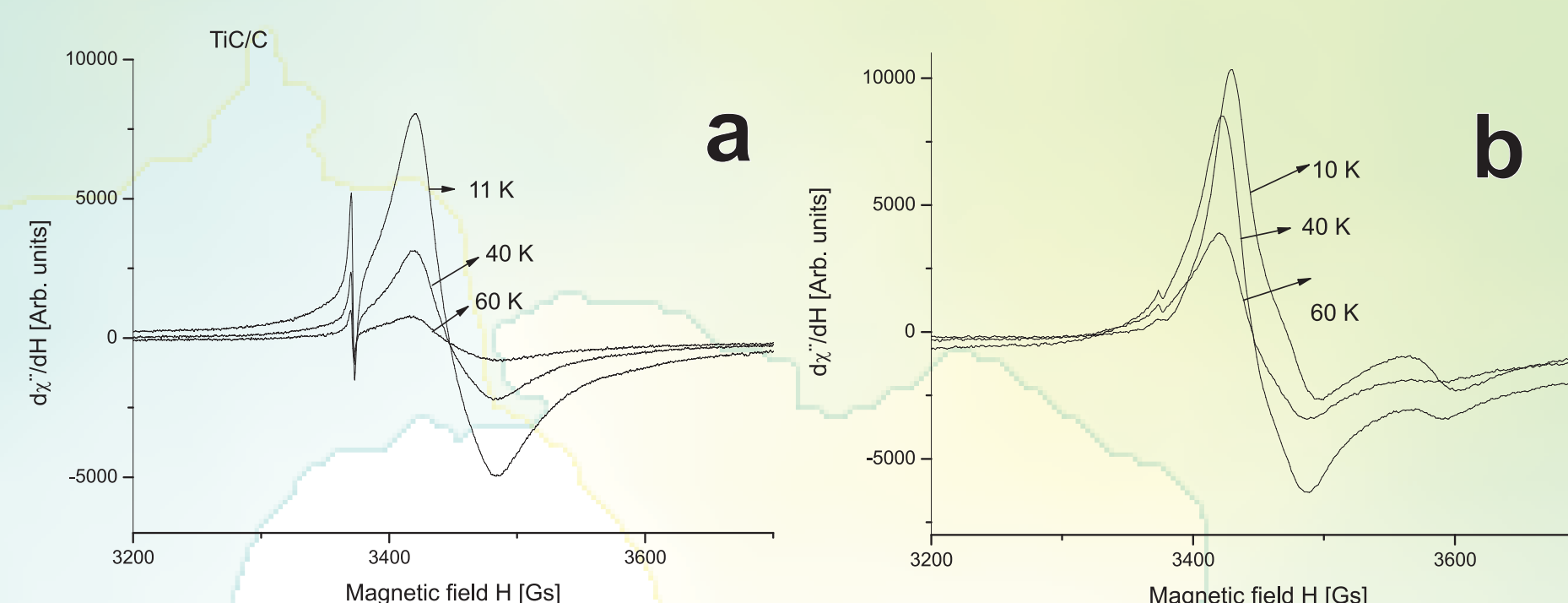
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## Abstract

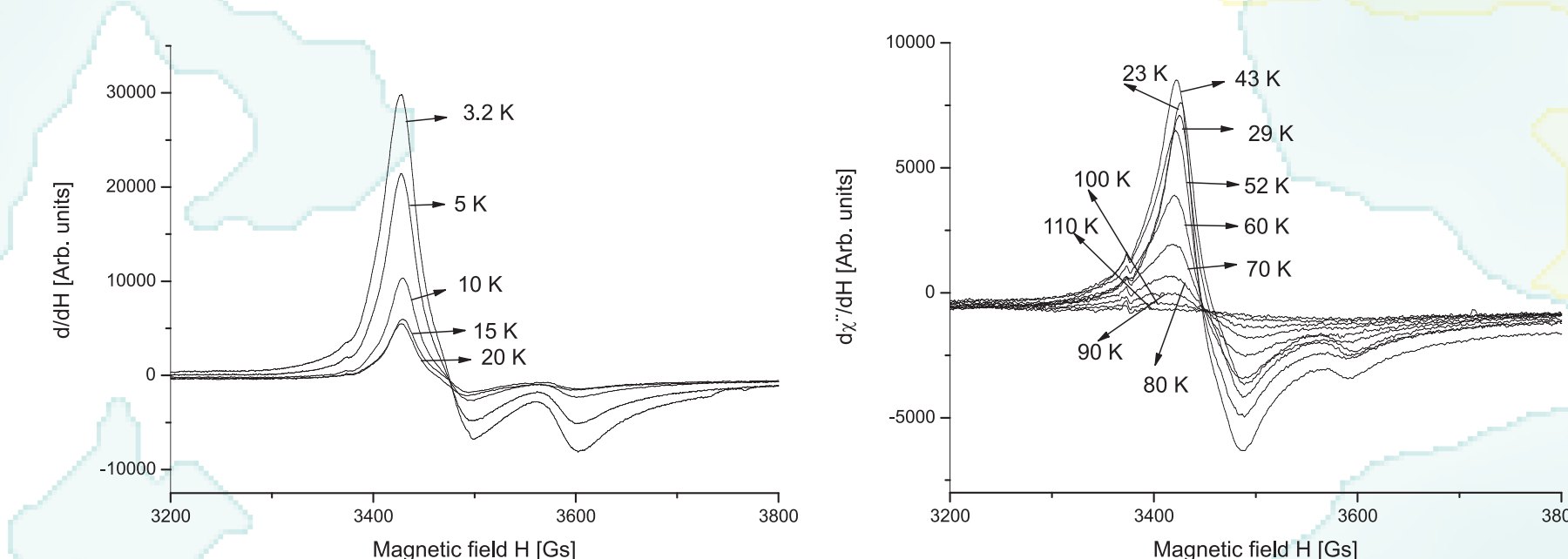
TiC/C nanocrystalline material: titanium carbide TiC dispersed in a carbon matrix has been prepared by a nonhydrolytic sol-gel process. Temperature dependence of the electron paramagnetic resonance (EPR) spectra of this material has been studied in the 3.5 K – 120 K range. Two asymmetric EPR lines have been recorded for fresh sample at temperatures below 70 K arising from  $Ti^{3+}$  complexes. One year later an additional EPR line has appeared while a narrow line attributed to conduction electrons has vanished. The existence of the paramagnetic centres connected with trivalent titanium ions is the result of disordering processes and the appearance of an additional line could be connected with the oxidation processes which could form new trivalent titanium complexes. The disappearance of a narrow EPR line suggests that the oxidation process (ageing effect) could influence the electrical properties of titanium carbide.



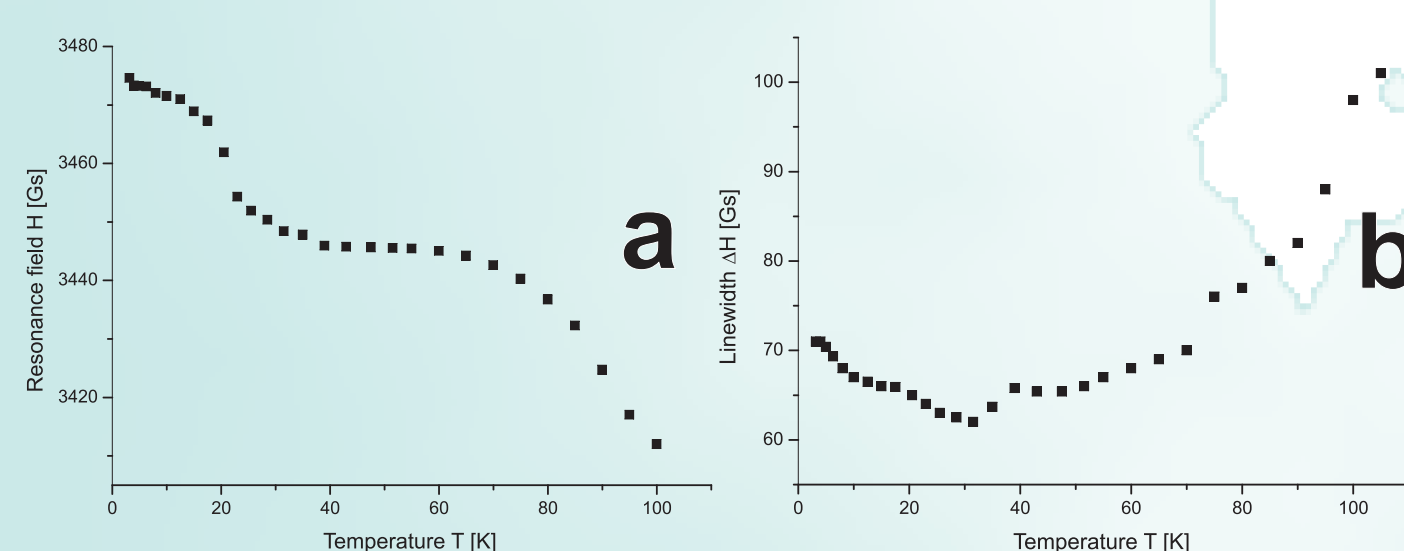
Transmission electron micrograph (TEM) of the TiC/C system (a) low resolution and (b) high magnification.



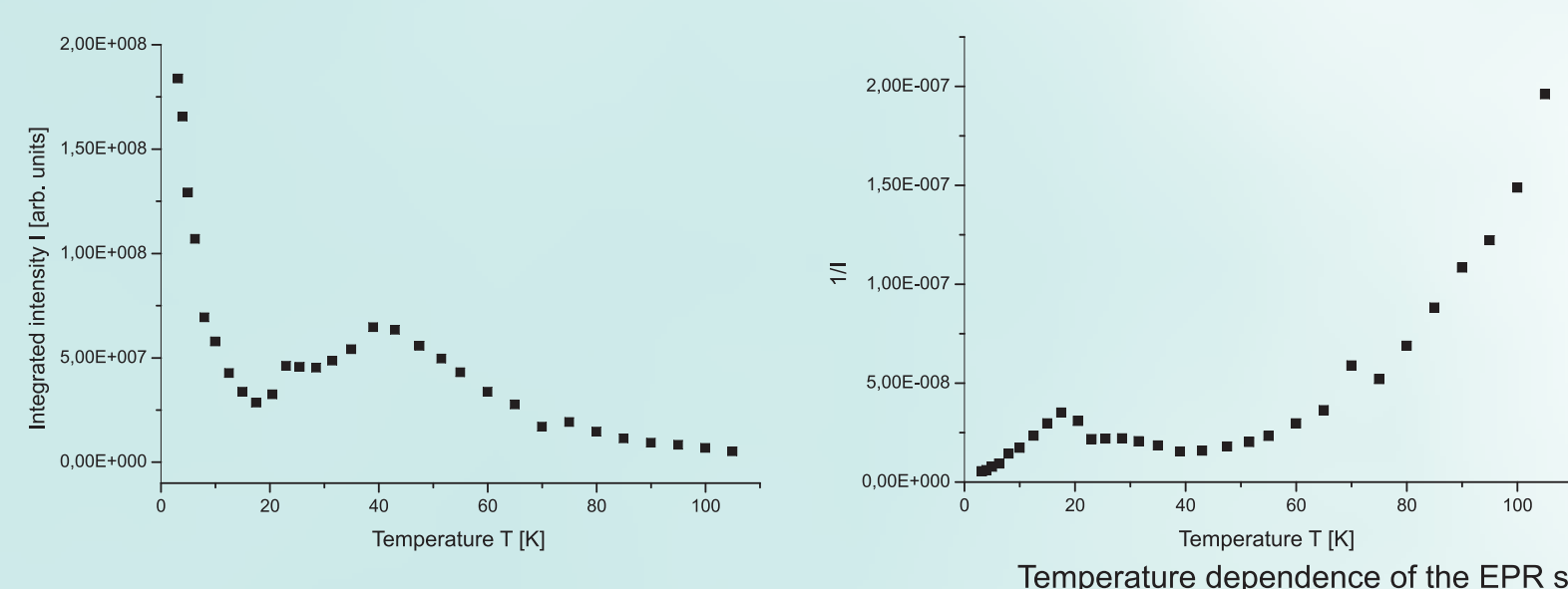
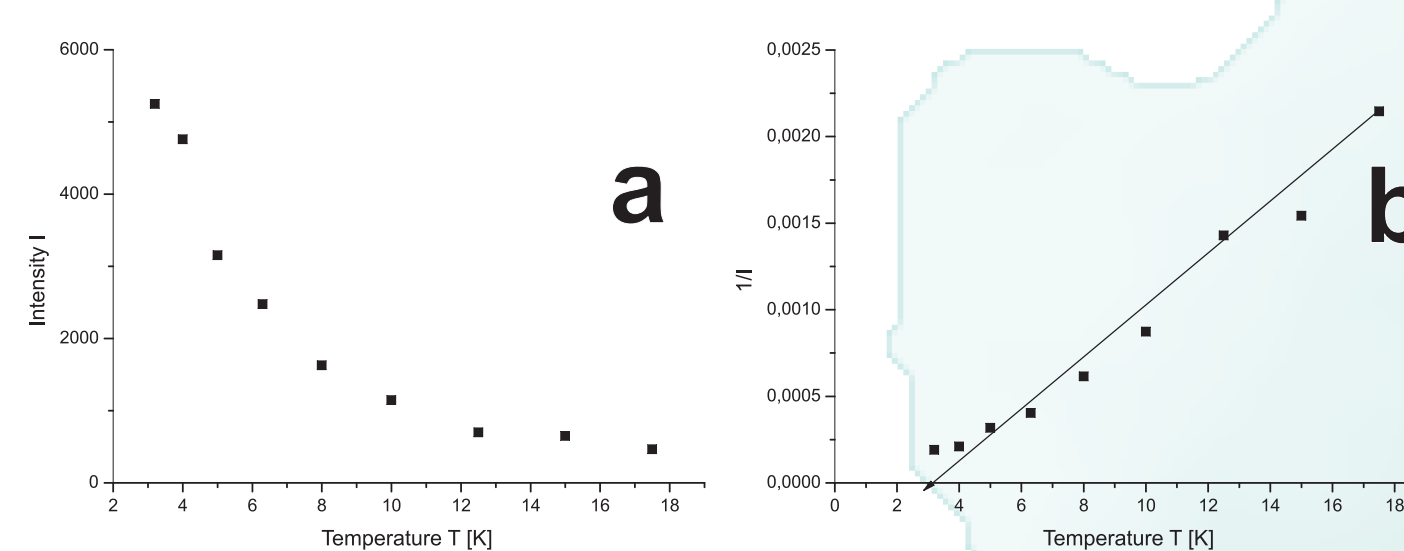
The EPR spectra of TiC/C in two different temperatures, (a) fresh sample and (b) ageing sample (after 1 year).



The temperature dependence of the EPR spectra of TiC/C for the ageing sample



Temperature dependence of the EPR spectra of TiC/Cx, (a) resonance field, (b) linewidth



Temperature dependence of the EPR spectra of TiC/Cx - integrated intensity.

## Conclusion

The EPR investigation of nanocrystalline titanium carbide dispersed in carbon matrix shows one year after synthesis three types of paramagnetic centers, a dominant two due to  $Ti^{3+}$  ions complexes and a very weak one due to localized defects coupled with the conduction electron spin system in the carbon matrix. It is expected that the ferromagnetic state appears at low temperature and its formation could be connected with the ageing process.



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