

Solid-State NMR Study of multiwalled carbon nanotubes

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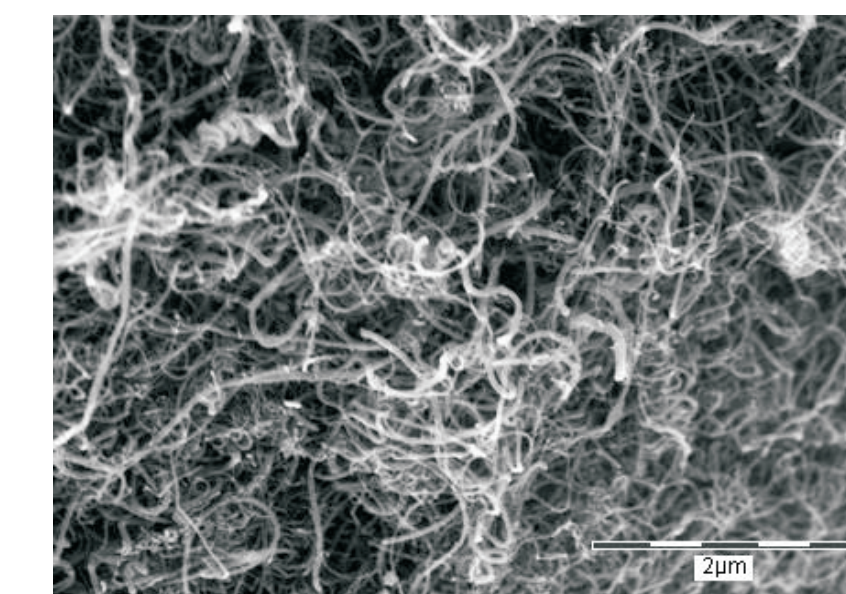
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Inno.CNT
INNOVATIONSALLIANZ
CARBON NANOTUBES

Introduction

With increasing mass production of multiwalled Carbon NanoTubes (Baytubes C150HP), first CNT-containing consumer goods are reaching the markets. For the development of CNT-containing reactive polymers composites, chemically-functionalized CNT with enhanced reactivity are subject of contemporary research.



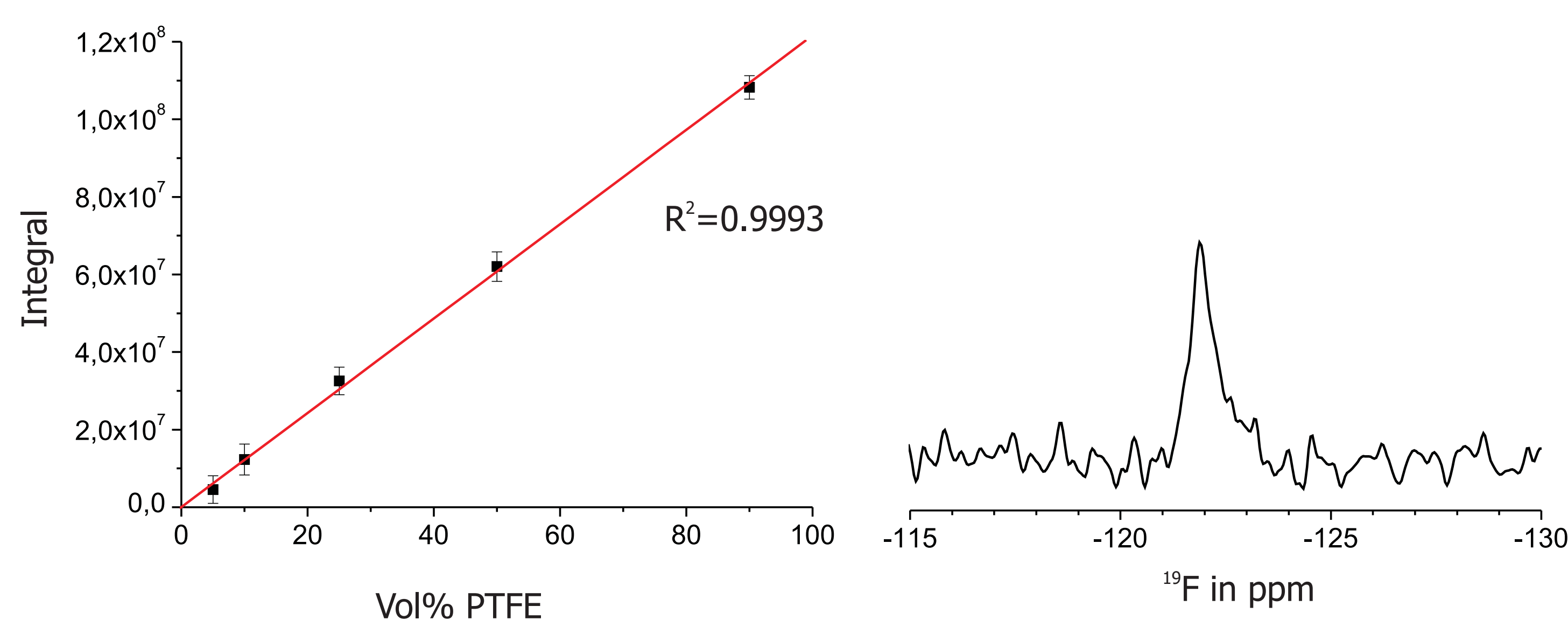
SEM picture of C150HP

Aim of the experiments

In order to assess possible health and environmental risks of carbon nanotubes, their physical and chemical properties have to be determined comprehensively. Since the presence of chemical functional groups may affect the persistence and biotoxicity of CNT, the aim of the present work is to develop reliable methods for quantitative and qualitative analysis of CNT functionalizations.

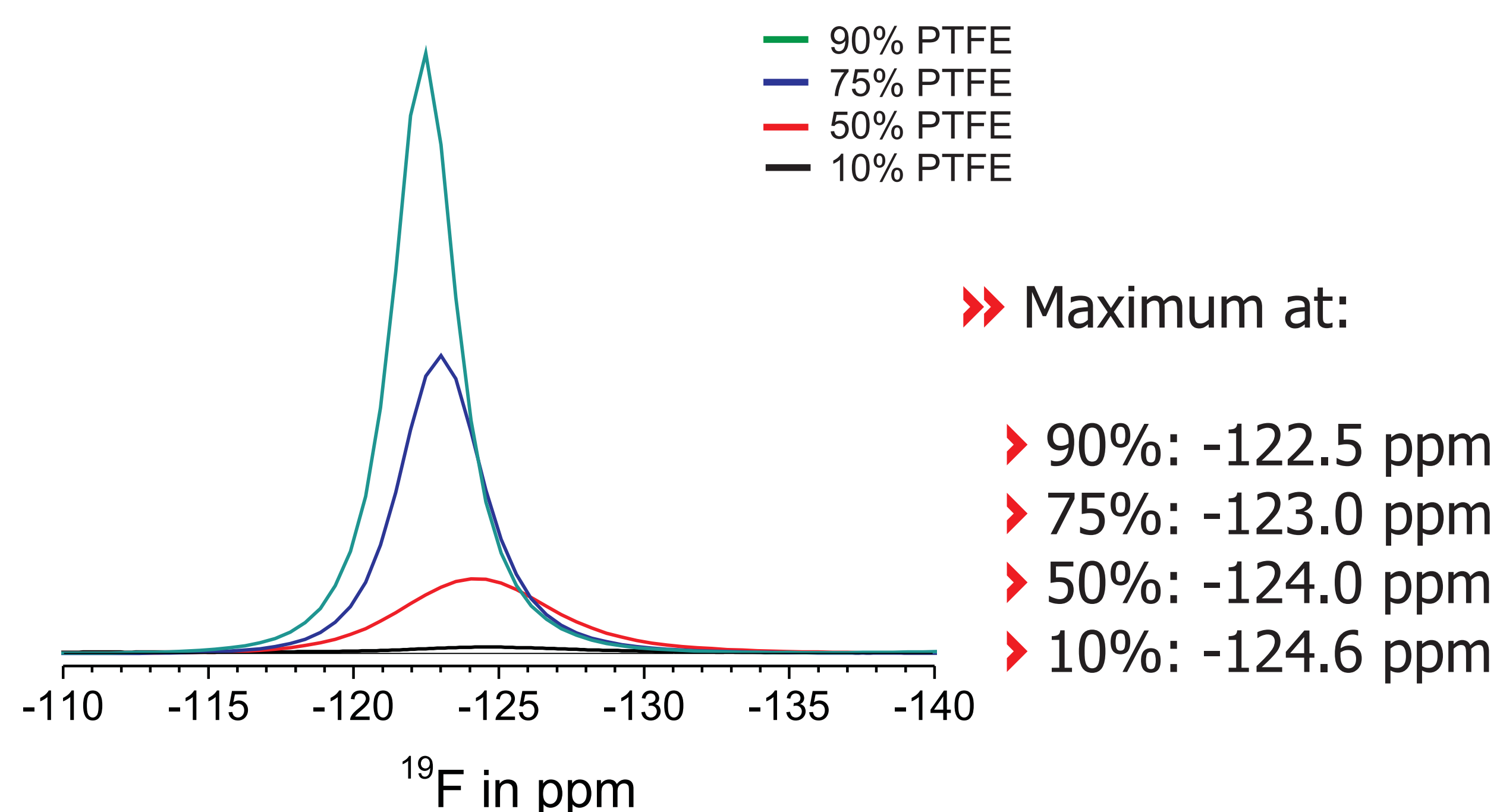
Experimental part

Linearity and detection limit of ¹⁹F



- ▶ Variation of concentration of PTFE in CaCO₃ to assess detection limit of ¹⁹F with 2.5mm F/X probe (9.4T).
- ▶ Detection limit: 50 µg/g. Measuring time: 12h

Variation of concentration of PTFE in CNTs



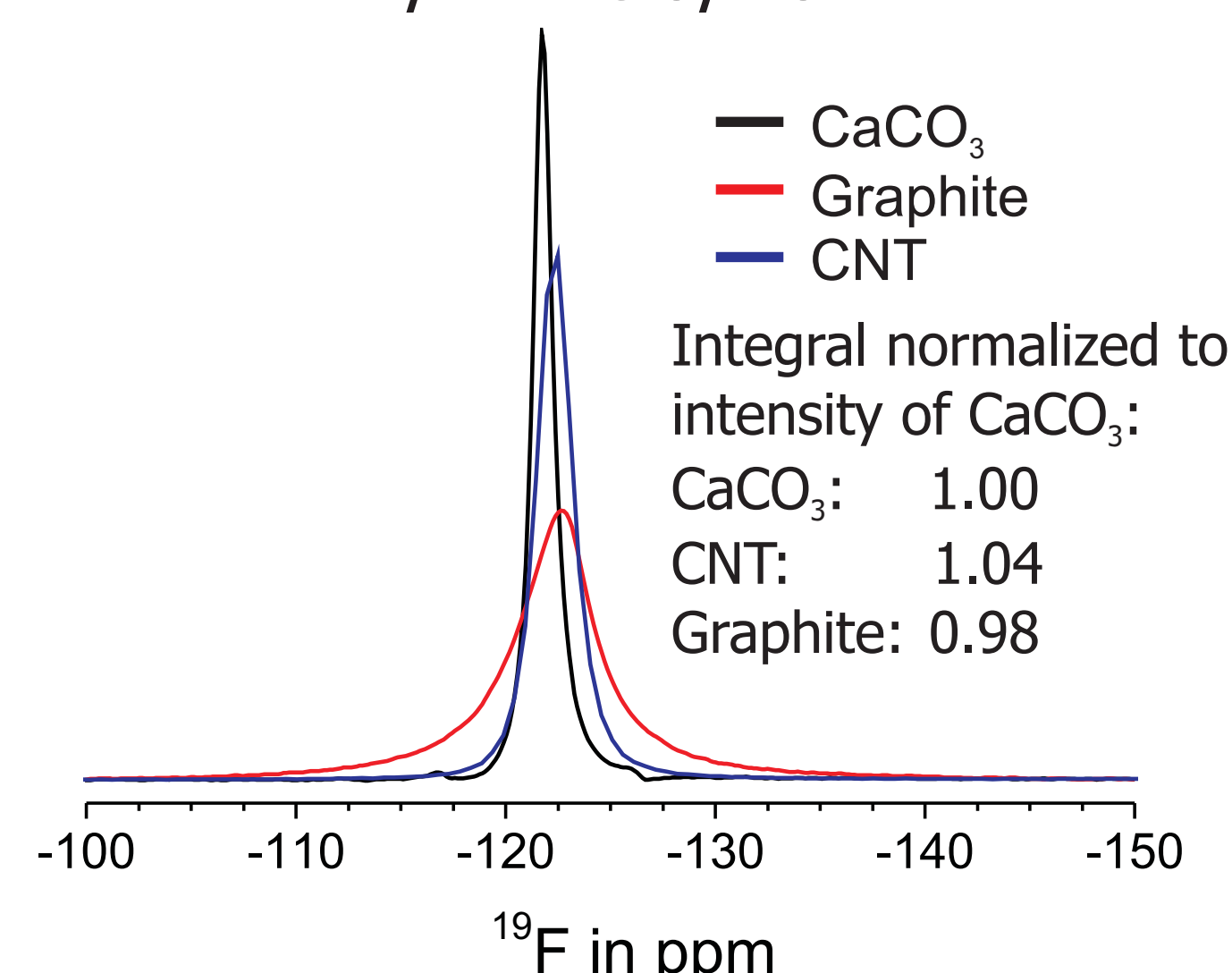
▶▶ Maximum at:

- ▶ 90%: -122.5 ppm
- ▶ 75%: -123.0 ppm
- ▶ 50%: -124.0 ppm
- ▶ 10%: -124.6 ppm

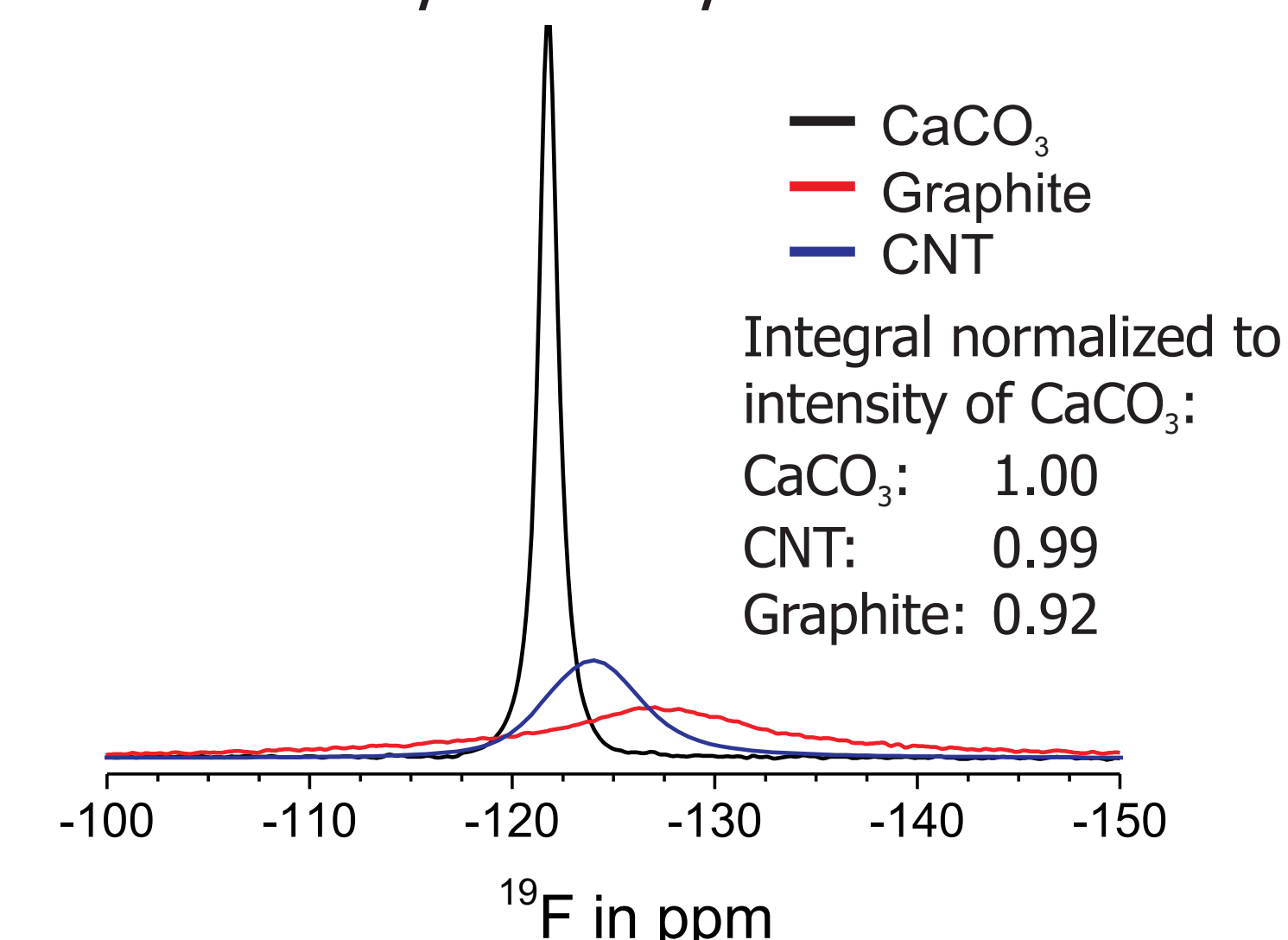
- ▶ PTFE peak at ¹⁹F = -121.9 ppm shifts high-field with increasing concentration of CNTs
- ▶ Broadening of signal with increasing CNT concentration

¹⁹F linebroadening as function of conductivity and loading

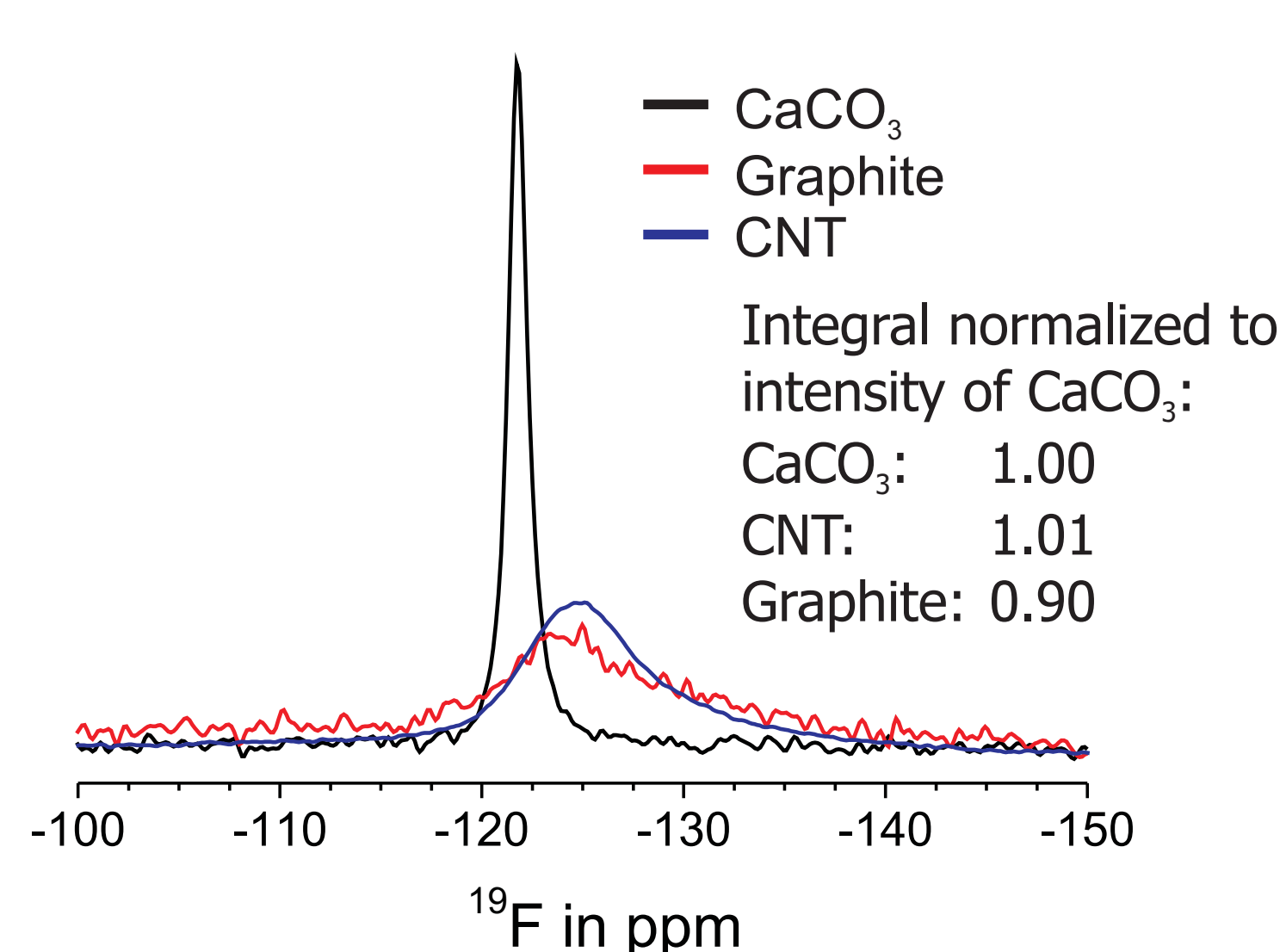
PTFE/X = 90/10



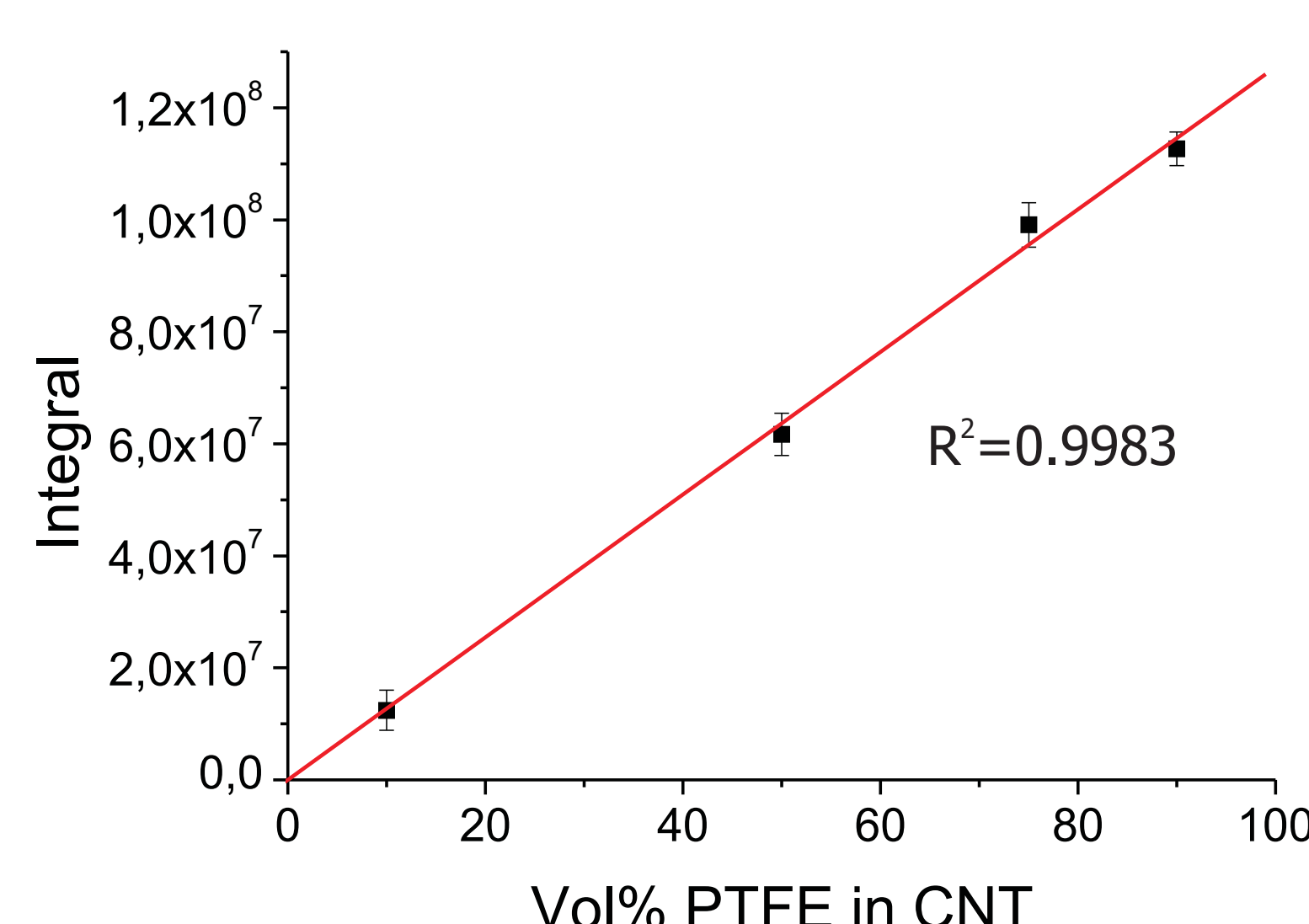
PTFE/X = 50/50



PTFE/X = 10/90



- ▶ PTFE peak at ¹⁹F = -121.9 ppm shifts high-field with increasing conductivity.
- ▶ Integral remains constant within error limit.



Conclusion

- ▶ With increasing CNT-content, the resonance is shifted towards high-field and broadened.
- ▶ Quantitative analysis of the ¹⁹F peaks in CNT containing probes is possible, despite of the peak shift and the broadening of the resonance.

Acknowledgement

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