COST 526

"Automatic Process Optimization in Materials Technology"

(APOMAT)

Half-Yearly Report (5)

1. Reporting Period	**1 January 2004 – 30 June 2004**
Project title	**Optimization of heat treatment of magnetic materials applying the thermomagnetic curves data**
Project leader Organization	**Dr. Tomáš Žák** Institute of Physics of Materials, AS CR, Žižkova 22, CZ-61662 Brno
Main collaborators involved	Lukasz Rauch Faculty of Metallurgy and Material Science Department of Computer Methods in Metallurgy University of Science and Technology, Krakow

2. Funding Situation	
Amount of money received specifically for COST	**7** kEuros
Other resources partially used for the project	**3** kEuros

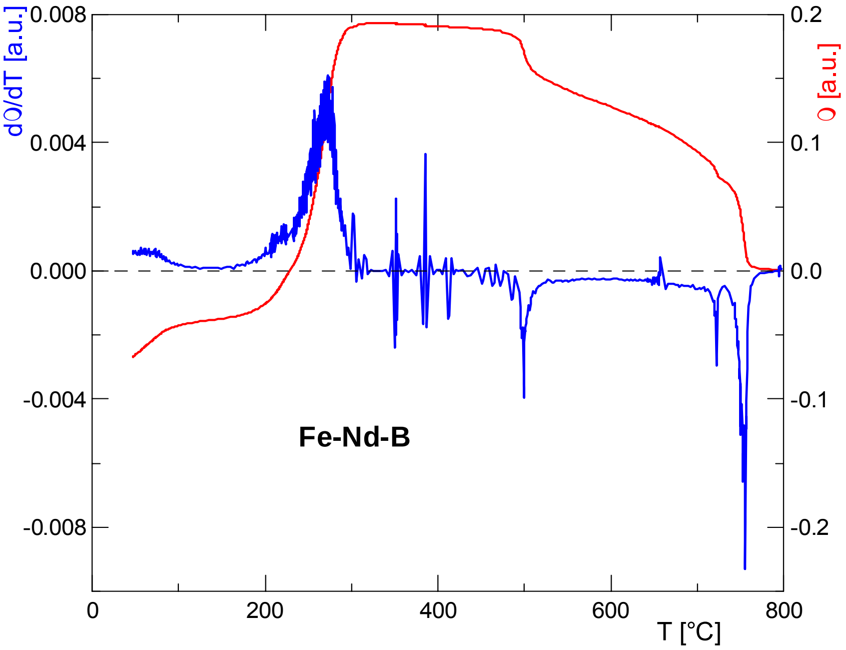
3. International Collaboration (mention group and type of work done in collaboration during the reporting period)
Participation in the Working Group Meeting in Krakow + project progress report ν YES π NO

4. Industry participation (mention name of companies and work done in collaboration during the whole project)
No

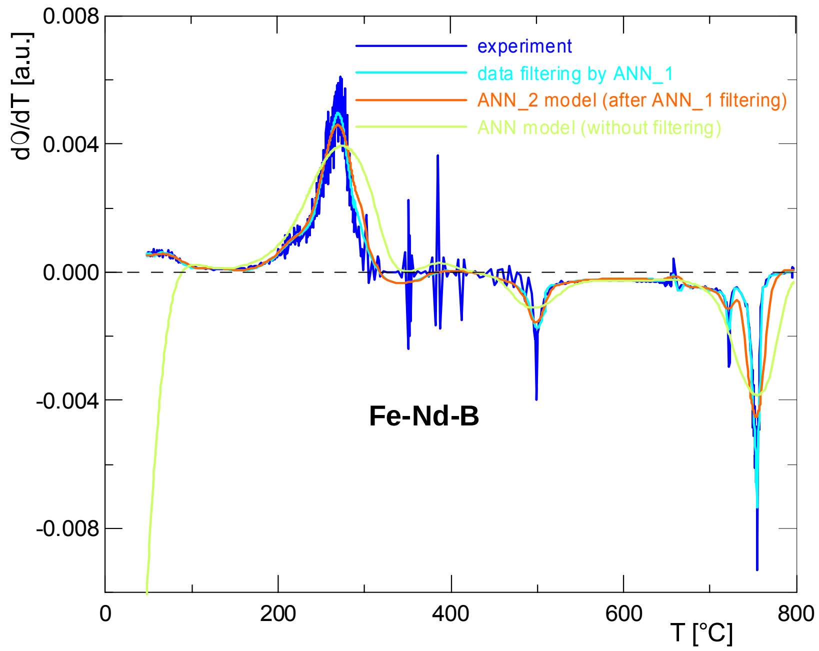
5. Meetings, visits, exchange of scientists, short-term scientific missions	**Location, date**

6. Progress within the reporting period
(Not exceeding 3 pages, including tables and figures)

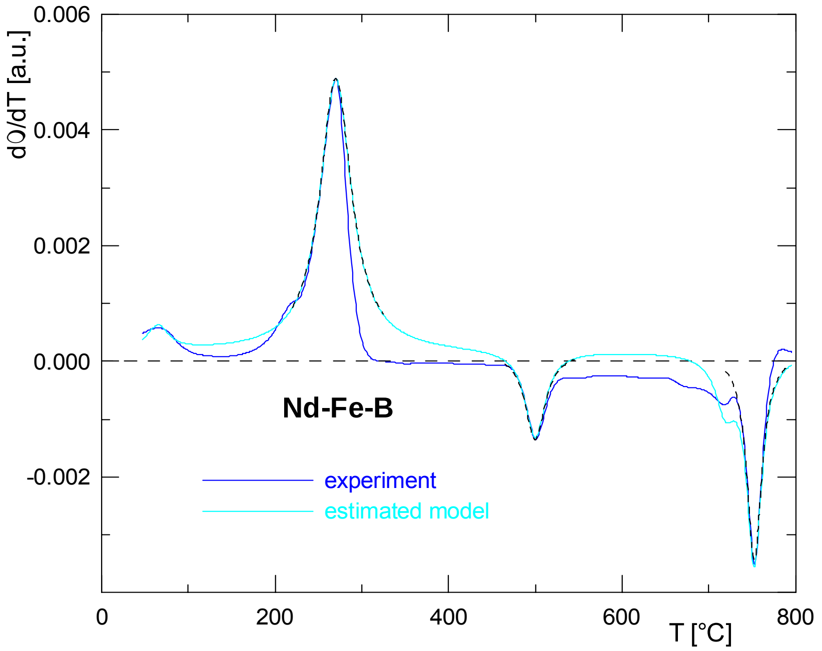
Thermomagnetic curve derivative. It is an apparently smooth curve but with problematic derivative. Peaks are not only at critical temperatures. Will be the nonparametric model helpful?



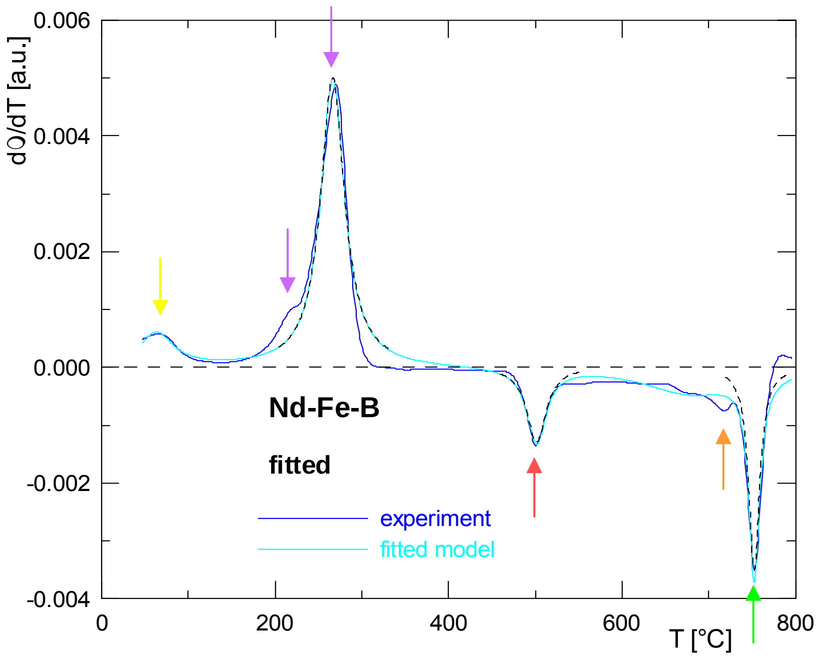
Nonparametric modelling of the thermomagnetic curve (without filtering). Here the preliminary filtering is necessary, as the noise disturbs the model. Only basic shape of the curve has been retained.



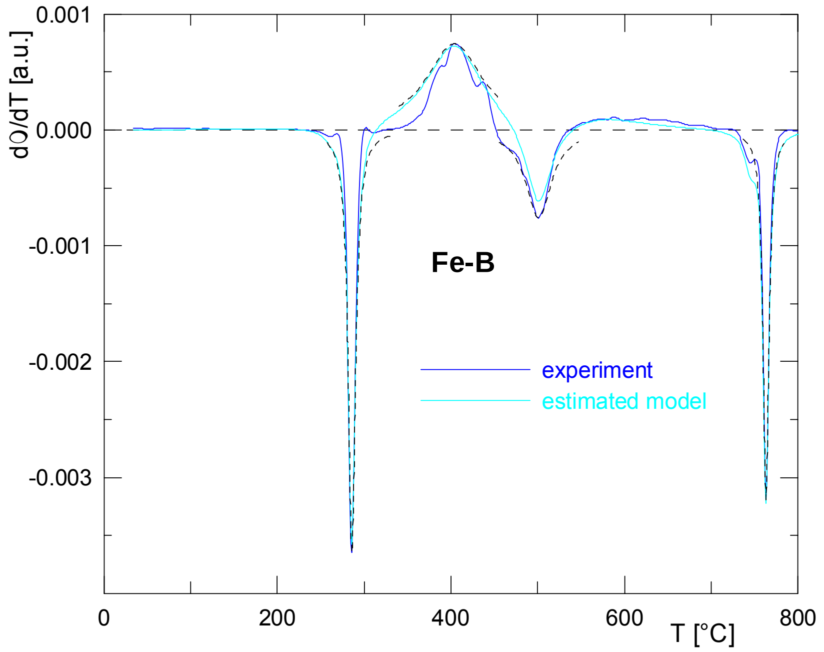
To avoid a human interaction and to be as near as possible to the nonparametric modeling, an algorithm was programmed for estimation of preliminary line positions. This algorithm is based on the tracing of the derivative curve behavior. It is able to distinguish between critical temperature peeks and artifacts partially.



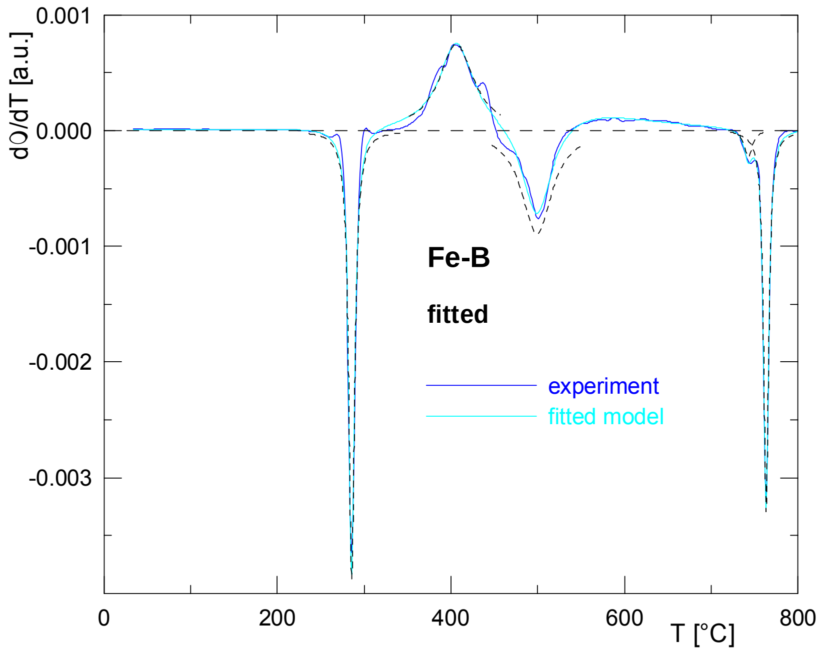
Next, you can see parametric least squares modelling of the thermomagnetic curve derivative with algorithmic estimation of peak positions. Critical temperatures are visible; various kinds of processes can be distinguished, similarly as various linewidths.



The program for algorithmic estimation of peak positions was tested on several thermomagnetic curves of various materials. Its results are still not perfect. There are problems with distinguishing of satellite minor lines. However, the estimation of main critical temperatures makes no problems.



Still, the least squares fitting gives us satisfactory results what about the most important points on the temperature scale.



We suppose that the enhancement of the lines estimation algorithm using second derivative of thermomagnetic curve allow us to complete the process of automatic estimation of critical temperatures most important for the heat treatment of amorphous magnetic materials.

7. List of publications

a) Published

Tomáš Žák, Oldřich Schneeweiss, Dragica Minić: Structure and phase analysis of electrochemically synthesized Fe–W, J. Magn. Magn. Mater. 272–276 (2004) e1119–e1121.

b) Submitted for publications

Jolanta Talar, Tomáš Žák, Lukasz Rauch, and Jan Kusiak: Filtering of thermomagnetic data curve using artificial neural network and wavelet analysis.

c) In preparation

Tomáš Žák: First steps with digital AC magnetometer.