# NZVI@C NANOCOMPOSITES WITH CONTROLLED PROPERTIES FOR WATER TREATMENT TECHNOLOGIES

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**Abstract**

Nanocomposites, which effectively combine reductive and sorption properties of zero-valent iron (ZVI) nanoparticles and carbon, respectively, promise a significant improvement in the field of water treatment technologies. We investigated mechanisms of thermally induced reaction of nano- and microscale ZVI particles with various morphology in carbon monoxide atmosphere up to 800 °C. During dynamic heating of the material, several consecutive transformations take place. Major structural changes start at 400 °C with transformation of ZVI to iron carbide, which is consequently transformed to wustite. Wustite temporarily represents a major iron-bearing phase between 600 and 660 °C and later completely disappears at 800 °C. Structural and phase changes are accompanied by deposition of carbon in various morphology (e.g., thin layers, nanotubes) after reaching 500 °C. Based on the detailed in-situ XRD monitoring, optimal temperatures (400 - 600°C) were chosen for the series of isothermal experiments for reaction-time optimization. The final materials are air-stable, strongly magnetic, iron based nanocomposites with controllable properties. We observed that even small change in the parameters of the synthesis enables to finely tune properties of nZVI@C nanocomposites, such as phase composition, magnetic properties, and specific surface area leading to changes in reactivity, sorption properties, and total efficiency in pollutant removal. Reactivity of selected samples was quantitatively evaluated by Cu2+ removal.

**Keywords:** Carbon, iron nanoparticles, nanocomposites, water treatment, solid state reaction

**ACKNOWLEDGEMENTS**

***This research was financially supported by Technology Agency of the Czech Republic "Competence Centres" (project TE01020218), the Operational Program Education for Competitiveness - European Social Fund (CZ.1.07/2.3.00/20.0155), and internal student grants IGA_PrF_2014017 and IGA_PrF_2014023 of Palacký University in Olomouc. The authors gratefully acknowledge to Jana Stráská and Michal Křížek for capturing TEM images and BET surface area measurement, respectively.***

**Author did not supply full text of the paper/poster.**