HYDROGEN CONFINEMENT MODULATED REVERSIBLE FORMATION OF GRAPHITIC DOMAINS IN POROUS CARBONS

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Flexible materials with the capability to reversibly form ordered domains and close porosity through the application of pressure and temperature are of high interest for a multitude of fields from energy storage to gas separation [1]. Nongraphitic carbons with nanosized anisotropic graphitic are traditionally considered a class of materials where such transformations are not possible. The reversible formation of graphitic domains in carbide-derived carbons [2] and zeolite-templated carbons are presented under H_2 loading and in the temperature range from 40 to 60 K (Figure 1). The formation of graphitic domains is based on the presented *in situ* neutron scattering (quasi-elastic, powder diffraction) data. The influence of the carbon materials' graphitic and porous structure [3] on the reversible formation of graphitic domains is presented and the applicability of the investigated structure transformation process is discussed.

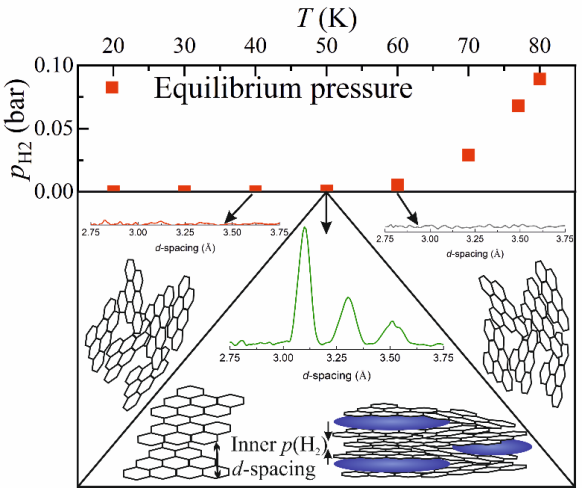

Fig.1 H_2 Pressure in the sample holder dependence on experimental temperature (upper) and the visualized nongraphitic carbon structures at different experimental temperatures guided by arrows (below)

References

[1] V.I. Nikolayenko, D.C. Castell, D. Sensharma, M. Shivanna, L. Loots, K.A. Forrest, C.J. Solanilla-Salinas, K. Otake, S. Kitagawa, L.J. Barbour, B. Space, M.J. Zaworotko, Nat Chem 15 (2023) 542–549.

[2] M. Koppel, R. Palm, R. Härmas, M. Russina, N. Matsubara, M. Månsson, V. Grzimek, M. Paalo, J. Aruväli, T. Romann, O. Oll, E. Lust, Carbon 174 (2021) 190–200.

[3] R. Palm, R. Härmas, E. Härk, B. Kent, H. Kurig, M. Koppel, M. Russina, I. Tallo, T. Romann, J. Mata, Carbon 171 (2021) 695–703.