A different aspect of chemical activation: Sol-gel method with Brønsted acids

Activated carbons are widely applied class of materials that can be chemically and morphologically tuned for a variety of purposes. The traditional definition of chemical activation is revisited by the selection of highly soluble, oxygen free and lignocellulosic precursors and three different type of activating agents. We obtain a sol-gel type carbon as in Pekala process[1] employing Brønsted acids at different ratios of solvent to precursor. X-ray Diffraaction (XRD) patterns confirm the disordered structure and the absence of crystalline phases. The pore systems of the synthesized carbons are investigated by N_2 and CO_2 sorption. Formation of mainly micropores is observed at low solvent amount however, the development of meso- and macropores are predominant and large total pore volumes obtained when the conditions approach to sol-gel process. Transmission electron microscopy (TEM) images give insight into the structure of carbons and suggests that the activation process proceeds by the phase separation due to the dissolution of the precursor in the solvent rather than a conventional impregnation.[2] The implementation of the same set of experiments on an oxygen-free precursor reveals that contrary to popular belief, the activation process is a physical phenomenon rather than chemical. The phase separation results in the development of either meso-or macropores depending on the solvent-precursor match.

References

1. R. W. Pekala, *Journal of Materials Science*, 1989, **24**, 3221-3227.
2. J. i. Hayashi, A. Kazehaya, K. Muroyama and A. P. Watkinson, *Carbon*, 2000, **38**, 1873-1878.