Water vapour adsorption with nanostructured polyphase compositions based on the solid component of welding aerosol

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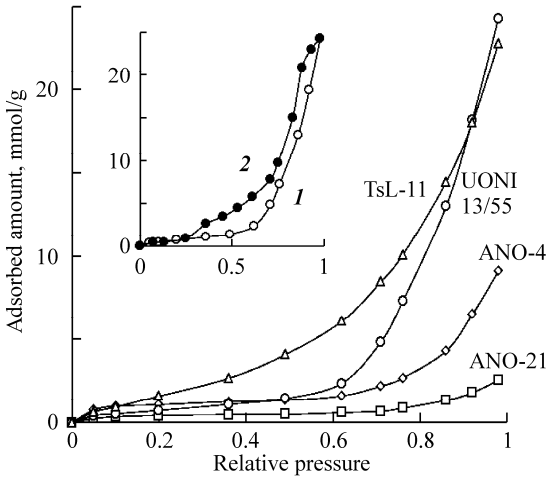
The main harmful factor in welding and related productions is welding aerosol (WA). The solid component of welding aerosol (SCWA) is an air dispersed particulate formed out of the welding arc in consequence of the oxidation and condensation of vapours of components forming electrode coatings and welding fluxes, and also metals themselves. Taking into consideration volumes and techniques of welding and related productions as well as materials used for them, it is important not only to decrease toxic effect of SCWAs on the environment and operating personnel but also to recycle solid wastes in order to obtain industrial and household products. The possibility of application of SCWAs as adsorbents of acid gases and catalysts for ozone decomposition has been found. The adsorption capacity of complicated compositions as respects to water vapor is usually one of the factors determining their activity as both adsorbents and catalysts however there are no data on SCWA performance in ad/desorption of water vapour.



SCWA samples obtained under the same conditions as a result of steel welding by ANO-4, ANO-21, TsL-11, and UONI13/55 electrodes of Ukrainian manufacture were used in the study. Since the electrodes differ by chemical compositions of wires and coatings, phase compositions of their SCWAs also are different: SCWA-ANO-4 and SCWA-ANO-21 predominantly contain magnetite (Fe_3O_4) and manganochromite $(Mn,Fe)(Cr,V)_2O_4$) whereas two other SCWAs additionally contain hematite (α-Fe_2O_3), goethite (FeOOH), fluorides and carbonates of both alkali and alkali-earth metals.

Figure shows the isotherms of water vapour adsorption obtained for all the SCWAs under study by well-known McBain gravimetric method and differing by their positions due to different amounts of water vapour adsorbed at the same relative pressure. The desorption of water vapour from all of them reveals the presence of capillary condensation hysteresis, the most pronounced for SCWA-UONI (see inset, water vapour adsorption (***1***) and desorption (***2***)). Substantial differences in adsorption parameters estimated by the use of BET equation are due to the differences in chemical and phase compositions of the SCWAs.

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