The order of the graphene layers in different activated carbon fibres.

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The reactivity and behaviour of carbon materials can be related to the following properties: porosity [1], chemical surface groups [2] and the presence of inorganic matter [3]. Another important factor is the microstructure of the carbon material or the order of the graphene layers [4,5]. It is well known that when large amounts of graphene layers are aligned and the order of those graphene layers increases, the material becomes less reactive. The crystalline graphite is the least reactive carbon material with sp^2 hybridisation, it presents well-ordered graphene layers with a constant spacing. The first step in order to study the influence of this factor is to use a technique to determine this type of order in the graphene layers. In general, XRD is the most used technique to detect crystalline phases. However, when the size of these phases is very small, techniques allowing characterisation down to micro or even nano meter scale are required.

In the present work, a complete characterization of activated carbon fibres (ACF) is carried out with several techniques, such as UPS, XPS, HRTEM and EELS. While the first two methods are applicable to the surface sensitive characterisation, HRTEM and EELS are suitable methods to establish the order of graphene layers at nanometer scale and to provide information about the bonding state of carbon atoms. The results obtained are also correlated to the sp^2/sp^3 ratio calculated from the kinetic energy of Auger electrons from C 1s orbital [6].

PAN based ACF, cellulose ACF and ACF obtained from coal tar pitch are studied. These activated carbon fibres exhibit different microstructures due to the different order of applied raw materials. ACF obtained from PAN has the highest order in the graphene layers (Fig.-1) and the ACF from cellulose present lower order (Fig.-2). The evaluation of the order in the graphene layers is important to predict or to explain the

different behaviour of the ACF when are submitted to oxidant atmospheres. The results of UPS, XPS and EELS will be presented.

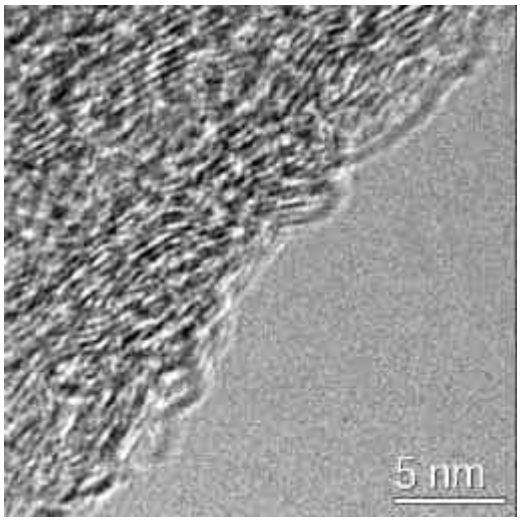

Fig.-1 HRTEM image of the PAN based ACF.

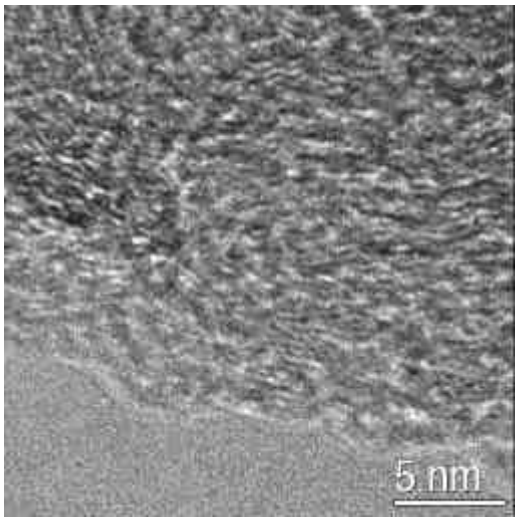

Fig.-2 HRTEM image of the cellulose ACF.

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