Introduction

The glassy carbons obtained by pyrolysis of thermosetting resins are well known for their resistance to crystallite growth during high-temperature exposure. Phase-contrast observations with transmission electron microscopy have shown that these carbons are composed of interweaved crystallites in a tangled geometrical arrangement (1). It has been suggested that the resistance to crystallite growth is due to this tangled microstructure (2). That considerable microporosity is present in the glassy-carbon microstructure is obvious from the relatively low density of this material. The role which the microporosity plays in the resistance to crystallite growth is the subject of this paper.

It is known from studies of isotropic pyrolytic carbons with microstructures similar to those of glassy carbons that high-temperature fast-neutron irradiation causes considerable densification of the tangled microstructure, obviously resulting in removal of much of the microporosity (3). The mechanism of this densification is thought to result from the expansion of individual carbon crystallites perpendicular to the layer planes and the shrinkage of the crystallites parallel to the layer planes. Thus, high-temperature irradiation of a glassy carbon should produce the tangled microstructure with greatly reduced microporosity and densification of irradiated and unirradiated material should allow a study of the effect of the microporosity on crystallite growth.

Experimental

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misalignment of neighboring crystallites and thereby make crystallite growth more difficult.

References

Figure 1

Microstructure of unirradiated carbon after annealing at 2200°C. Arrows indicate bands which are images of crystallites whose layer lines are perpendicular to the surface of the specimen.

Figure 2

Apparent crystallite size ($L_C$) as a function of annealing temperature.

Figure 3

Microstructure of irradiated carbon after annealing at 2200°C. Arrows indicate diffraction contrast fringes similar to those observed in isotropic pyrocarbons.