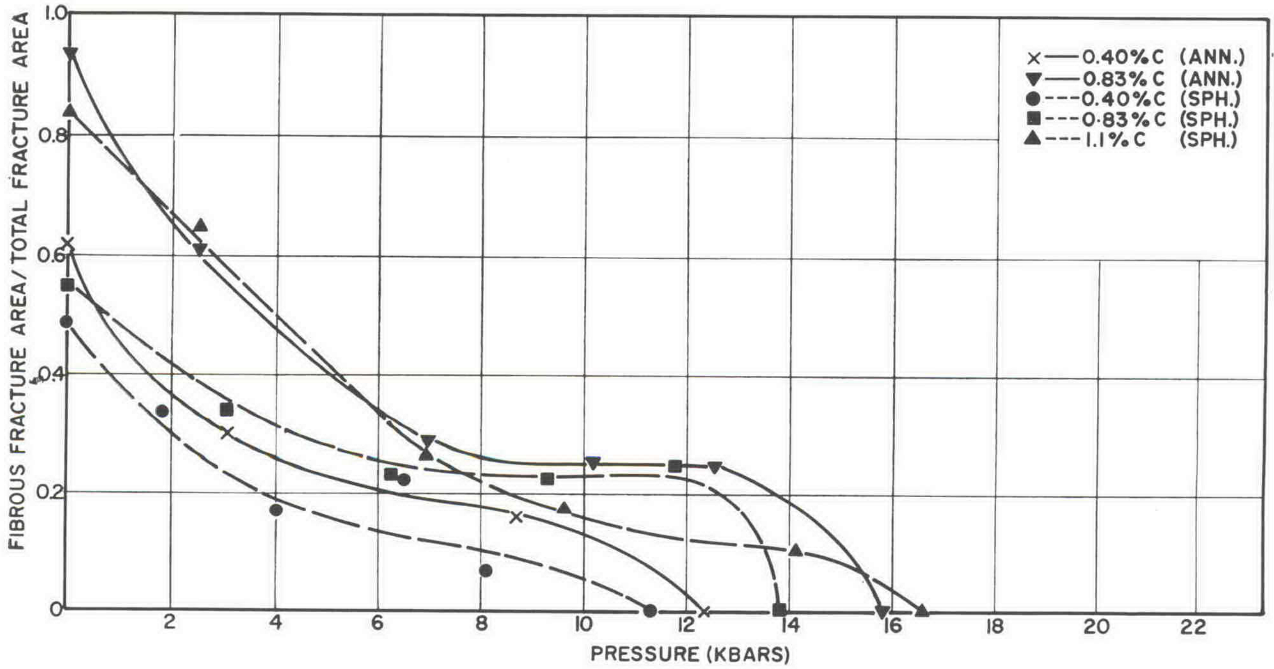

Fig. 9. Fibrous to total fracture area vs pressure for Fe – C materials.

fracture mode to progressively convert to one of planar shear (12). Such a shift in fracture mode may not change the macroscopic fracture appearance, but is observed by electron fractographic examination.

CONCLUSIONS

1. The effect of pressure upon the ductility of a series of annealed and spheroidized Fe – C materials ranging in carbon content from 0.004 to 1.1% C is highly structure sensitive in terms of the amount, shape and distribution of the cementite phase.

2. Annealed 0.004% C and spheroidized 0.40, 0.83 and 1.1% C materials exhibit a linear relationship between true strain to fracture and pressure with the slope decreasing with increasing carbon content.

3. Annealed 0.40, 0.83 and 1.1% C materials exhibit a polynomial relationship between pressure and true strain to fracture with the slope increasing with increasing pressure. The slope at low pressure and that for the best fit linear relationship for these material decreases with increasing carbon content. The slope at high pressure approaches that for the spheroidized materials.

4. The elongation as a function of pressure increases rapidly at lower pressures, then levels, or tends to level off, at higher pressures in all but the brittle annealed 1.1% C material. The leveling off of the increase in elongation is attributed to the pressure only affecting the area reduction in the necked region and not the uniform strain.. In the 1.1% C material, the elongation progressively increases with no leveling off even at 23.8 kbars. This is a combined effect of an effective increase in uniform strain, since brittle fracture is retarded, plus the contribution of the area reduction in necking.

5. No single or linear relationship exists for the materials investigated between pressure coefficient of ductility and strain hardening coefficient. A linear relationship does exist for the annealed 0.004% C and the spheroidized 0.40, 0.83 and 1.1% C materials, the remaining annealed materials falling far off this linear relationship.

6. No linear or continuous relationship exists between the ratio of fibrous to total fracture area as a function of pressure in those materials exhibiting a cup-cone type fracture at atmospheric pressure. There is a general decrease in the area ratio going to zero for all of the materials at high pressure. The pressure at which the fracture converts entirely to planar shear generally increases with increasing strength.

ACKNOWLEDGMENTS

Appreciation is expressed to the Materials Research Institute, Rensselaer Polytechnic Institute, and to the Benét Research and Engineering Laboratory, Watervliet Arsenal, for the use of their facilities. Appreciation is also expressed to Mr. H. Nazarian for his assistance in the conduction of the high-pressure tests.

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