SUPPORTED WEDGE TYPE GIRDLE APPARATUS

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Large volume (about 50cc of sample region) girdle apparatus for 60 kb region was designed. The tungsten carbide core was supported by the six wedge segments to obtain high external pressure at outer radius of the core. The analysis was made on the function of compressible gasket. The mechanical behaviors of the gasket materials were examined using a flat anvil apparatus. The results of pressure calibration in this apparatus were discussed on the basis of gasket function.

The operational characteristics of the apparatus and problems associated with high temperature-high pressure generation were discussed.

Introduction

A large scale girdle apparatus was designed to serve the synthetic work of diamond and cubic boron nitride. Increase of pressurized volume in a high pressure and high temperature apparatus is important to control temperature and pressure distributions of the reaction chamber.

In this paper we report (1) design of supported wedge type high pressure vessel (2) mechanical behaviors of the compressible gasket and (3) miscellaneous operation conditions of the apparatus up to 60 kb and 1500^{o}C region.

Design of girdle cylinder

The girdle cylinder was designed so as to reduce the ratio of external to internal diameter. The dimension of this cylinder is shown in Fig.1. The bor of the tungsten carbide core is 40 mm in diameter. Total diameter of the girdle cylinder was 620 mm. The ratio of externa to internal diameter is 15.5.

The core was press-fitted into the bor of the wedge. The wedge was composed of six segments. The internal surface of the wedge has 1.5^{o} tapering angle. The core was compressed by the interference betwee the core and wedge. Designed external pressure to the core was 155 kg/mm^2.

If we put the ratio of external to internal diameter of the core as k_o, the calculated maximum tangential stress at the inner radius of the core is,

$$\sigma_t = \frac{K_o^2+1}{K_o^2-1} P_i - \frac{2K_o}{K_o^2-1} P_m$$

where Pi is internal pressure and Pm external pressure at the outer radius of t core.

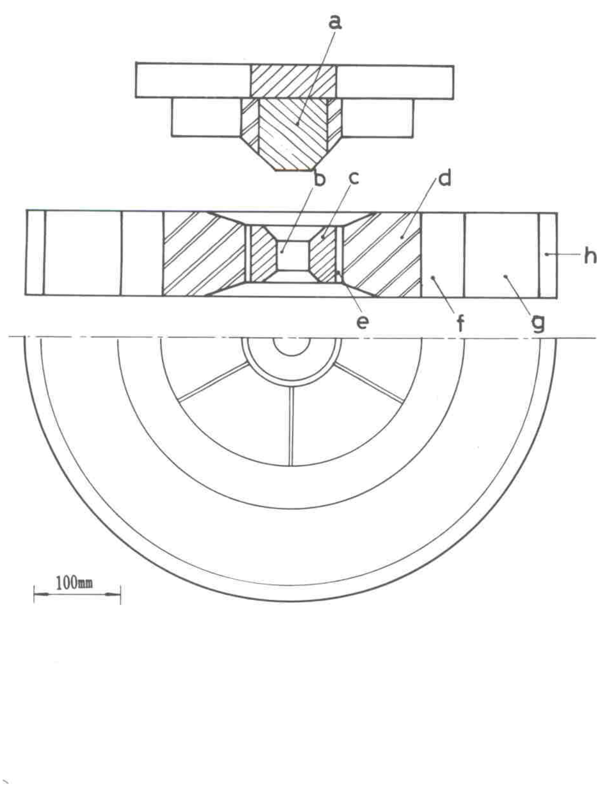

FIG.1. The schematic section of the girdle cylinder and anvil.

a. Tungsten carbide anvil
b. Sample chamber
c. Tungsten carbide core
d. High-speed-steel wedge
e. Shim
f. Binding ring(II) SNCM-8 steel
g. Binding ring (I) SNCM-8 steel
h. Safety ring

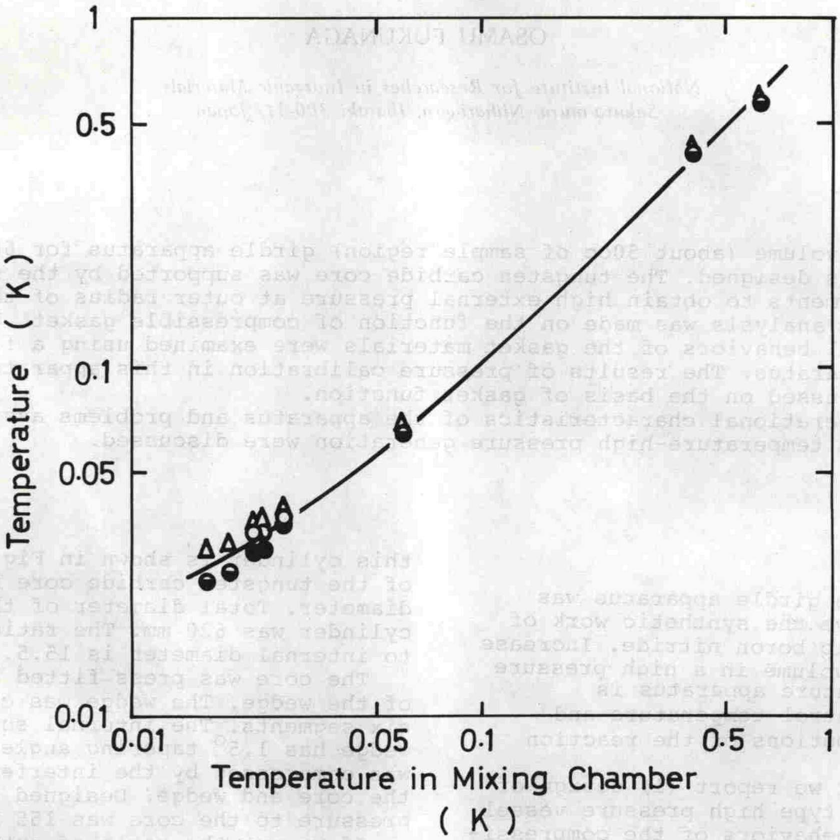

Fig. 7 Temperature distribution in the D-I apparatus

● ..... temperature of mixing chamber body

o ..... temperature of upper flange

Δ ..... temperature of lower flange