Chapter 7: Routine characterisation

7.1. Introduction

Chapters 7, 8, 9 and 10 give analyses of the fabricated compacts. While the experimental work of chapters 8, 9 and 10 required development of methods, analyses in which established and routine methods used are presented in this chapter.

7.2. Mercury porosimetry on green compacts

To test the integrity of samples prepared with nanosized powders and by pressure filtration a non-diamond containing green compact prepared with the pressurised air press (section 6-3, page 50) was subjected to mercury porosimetry[‡]. At that stage of this project work was still conducted with AKP-50. Data for the mercury porosimetry run are given in fig. 7-1.

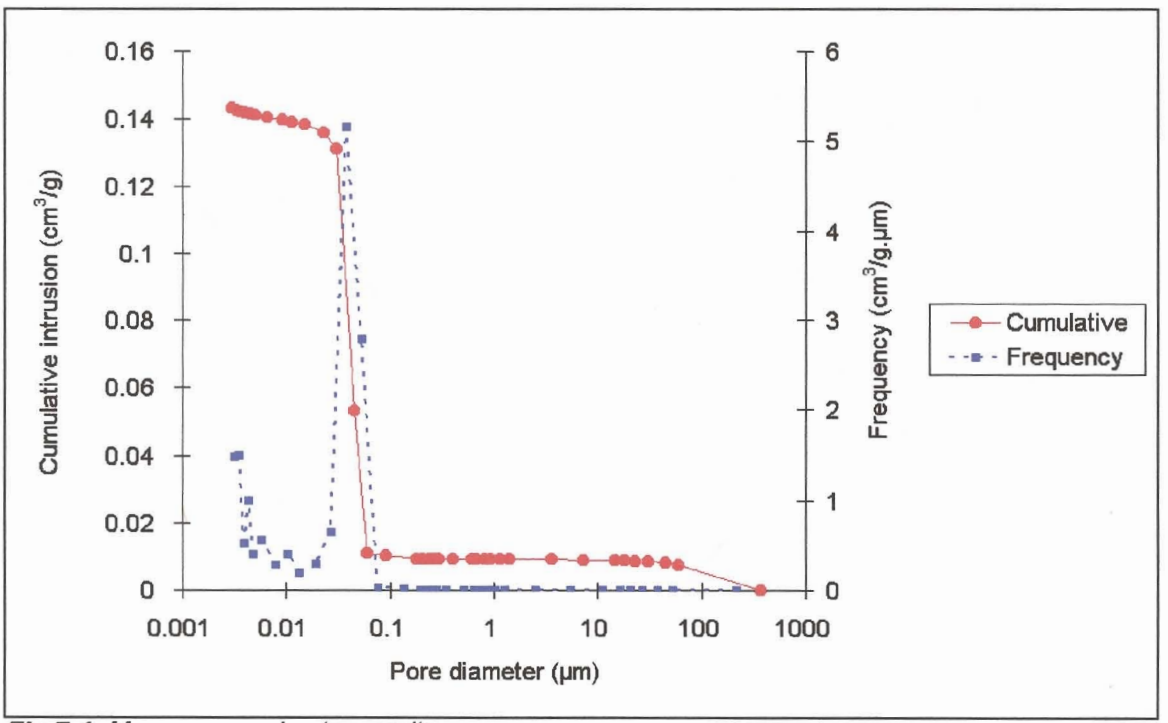

***Fig.7-1**: Mercury porosimetry results.*

[‡] Atomic Energy Corporation, Pelindaba, South Africa.

7.3 Fired density

Densities were determined by immersion in water. With repeated measurements values did not vary more than ± 1 relative density percentage points for each sample.

Results for sintering are reported in fig. 7-2.

The densities achieved by HIPping, together with relative amounts of constituents are given below (table 7-1). All α-alumina samples densified to almost their full relative densities. There is no correlation between HIPping temperature and density.

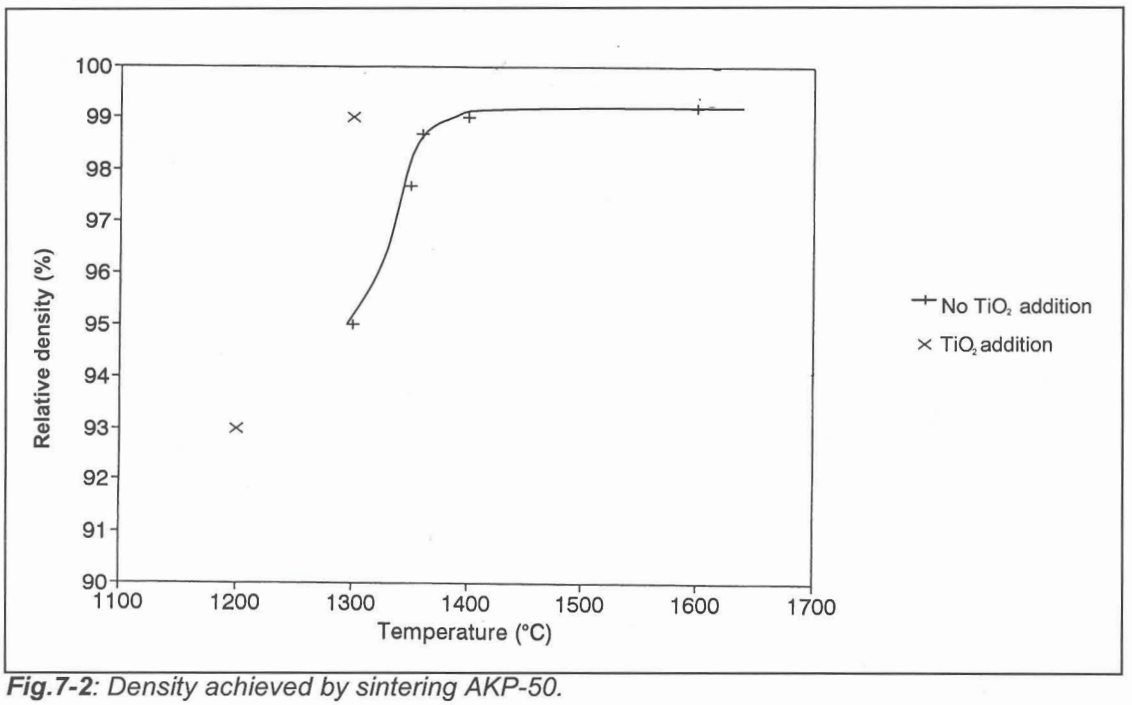

***Fig.7-2**: Density achieved by sintering AKP-50.*

***Table 7-1**: Densities achieved.*

Sample.	Relative density (%)
0◊-α-CP-H1400	99
15◊-α-CP-H1400	97
15◊-α-CP-H1350	98
0◊-α-Pα-H1350	98
0◊-α-HP-H1300	99
15◊-α-HP-H1300	99
15◊-α-pH-H1300	96
15◊-α-HP-H1300	100
15◊-α-HP-H1250	99
15◊-α-pH-H1250	99
0◊-α-CP-H1250	100
0◊-α-Pα-H1200	99
15◊-α-CP-H1200	99
0◊-γ-Pγ-H1200	83
0◊-γ-Pγ-H1250	96

7.4. Raman analysis

The Raman spectra[‡] in fig 7-3 were obtained with freshly fractured surfaces. At least three different points were analysed on each sample and for each sample a typical spectrum is shown. Note that the area covered by a single measurement is in the order of 0.5 mm and therefore includes several exposed diamond particles. It is not possible to focus on a single diamond particle.

[‡] Institute for Applied Materials, Faculty of Science, University of Pretoria, South Africa.

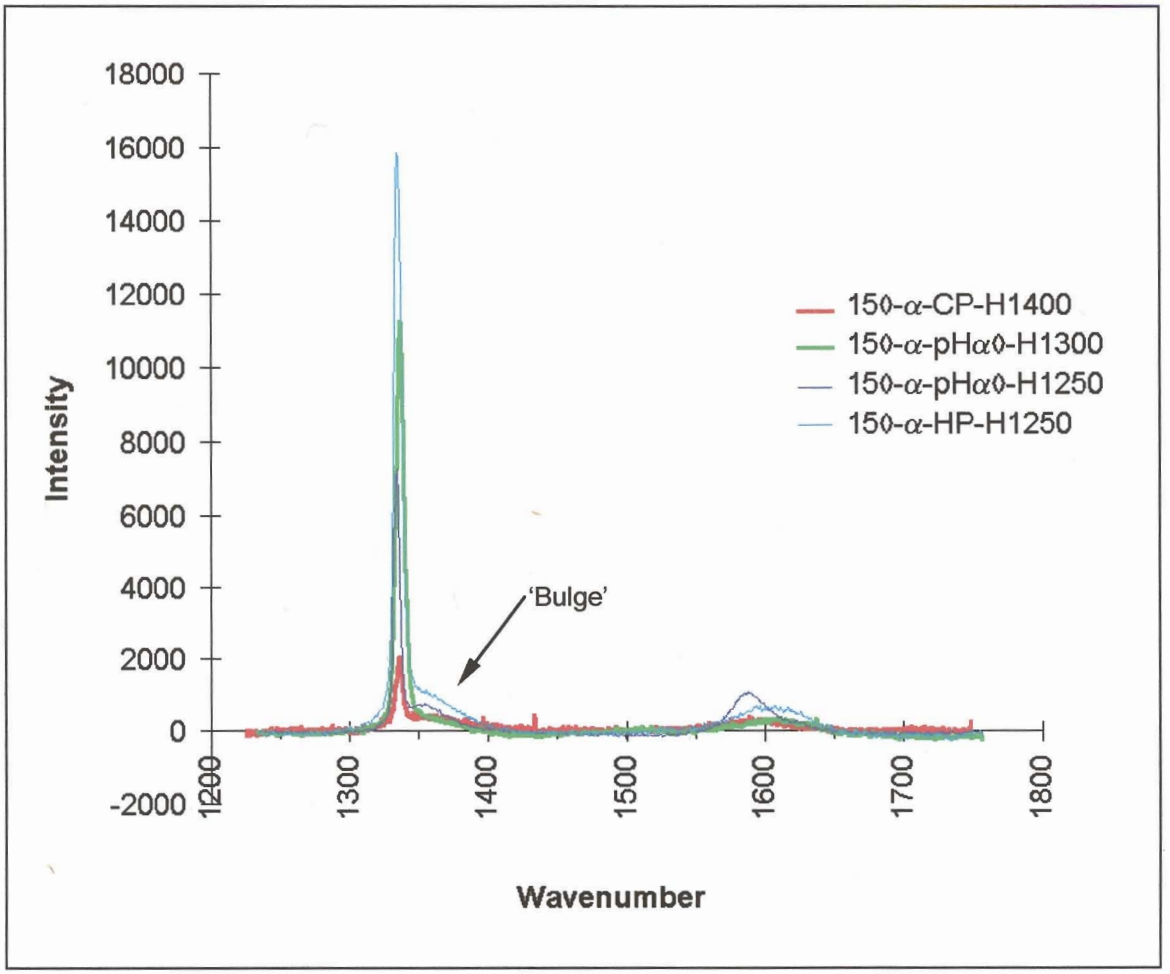

***Fig. 7-3**: Raman spectra for the analysed diamond containing samples. The indicated 'bulge' is discussed in section 11.1.3.*