UNIVERSITI SAINS MALAYSIA

First Semester Examination
2014/2015 Academic Session

December 2014 / January 2015

EBB 443/4 – Technical Ceramics
[Seramik Teknikal]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains ELEVEN printed pages before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

This paper consists of SEVEN questions.
[Kertas soalan ini mengandungi TUJUH soalan.]

Instruction: Answer **FIVE** questions. If a candidate answers more than five questions only the first five questions answered in the answer script would be examined.
*[**Arahan**: Jawab **LIMA** soalan. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]*

The answers to all questions must start on a new page.
[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]

You may answer a question either in Bahasa Malaysia or in English.
[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

In the event of any discrepancies in the examination questions, the English version shall be used.
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

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1. Figures 1 and 2 show the microstructural changes due to various amount of CeO_2 (from 0 to 15 wt.%) and $CaCO_3$ (from 0 to 13 wt.%) additions in ZTA ceramics, respectively. All samples were sintered at 1600°C for 4 hours in the air atmosphere. Based on these micrographs, evaluate the role of both CeO_2 and $CaCO_3$ for the improvement of ZTA ceramics properties. Explain clearly on how both additives behave during sintering process.

Rajah 1 dan Rajah 2 masing-masing menunjukkan perubahan mikrostruktur seramik ZTA akibat penambahan pelbagai jumlah CeO_2 (dari 0 ke 15 wt.%) dan $CaCO_3$ (dari 0 ke 13 wt.%). Semua sampel telah disinter pada 1600°C selama 4 jam pada atmosfera udara. Berdasarkan kepada mikrograf-mikrograf ini, lakukan penilaian berkaitan peranan kedua-dua CeO_2 dan $CaCO_3$ terhadap penambahbaikan sifat-sifat seramik ZTA. Huraikan dengan jelas bagaimanakah kelakuan kedua-dua bahan tambah ini semasa proses pensinteran berlangsung.

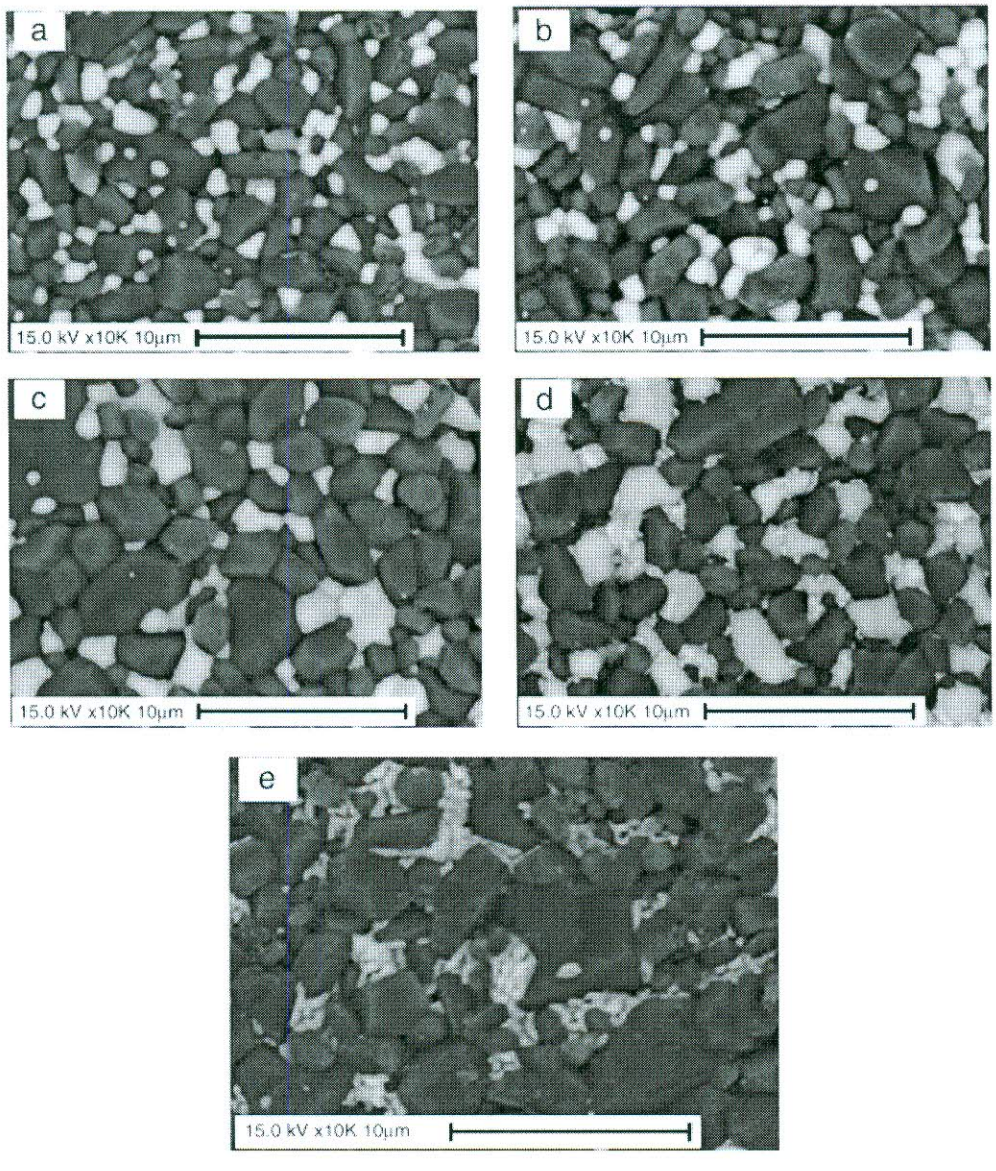

Figure 1. Scanning electron micrographs of ZTA ceramics with (a) 0 wt.% CeO_2, (b) 1 wt.% CeO_2, (c) 5 wt.% CeO_2, (d) 10 wt.% CeO_2, and (e) 15 wt.% CeO_2. Light grains: zirconia; dark grains: alumina

Rajah 1. Scanning electron micrographs of ZTA ceramics with (a) 0 wt.% CeO_2, (b) 1 wt.% CeO_2, (c) 5 wt.% CeO_2, (d) 10 wt.% CeO_2, and (e) 15 wt.% CeO_2. Light grains: zirconia; dark grains: alumina

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