

**COMBINED DILATOMETRY AND MASS SPECTROMETRY OF SINTERING  
AND EVOLVED GASES OF BARIUM TITANATE AND ZIRCONIUM  
DIBORIDE WITH SINTERING ADDITIVES**

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**ABSTRACT**

A combined dilatometer mass spectrometer system (CDMS) is used to monitor the gas phase species and sintering progress in real time during the heating of barium titanate and ultra high temperature ceramics (UHTCs), including zirconium diboride and sintering additives. For loose powder and pressed samples of barium titanate heated at different rates, two families of signals were observed by mass spectrometry at mass to charge ( $m/z$ ) ratios of 44 and 64 prior to the onset of sintering at 1150°C, and were assigned as carbon dioxide and sulfur dioxide. The sources for carbon dioxide and sulfur dioxide evolution include organic impurities arising from processing, exposure to ambient organic material, adsorbed carbon dioxide and residual unreacted or surface barium carbonate and barium sulfate. The UHTCs and common sintering aids heated in the CDMS individually and in mixtures include zirconium diboride, boron carbide, silicon carbide, boron oxide, zirconium oxide, zirconium disilicide, boron nitride spray, and organic binder, dispersant, and surfactant. Signals below 660°C for these UHTCs are attributed to the decomposition of organics present in the boron nitride spray, binder, dispersant, and surfactant. The signals above 900°C were determined to be CO and CO<sub>2</sub>.