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THE INVESTIGATION OF SOME PHYSICAL AND ELECTRICAL PROPERTIES OF MGO WITH USED BULB GLASS

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Abstract. Ceramic compact of MgO +WT% of UBG were sintered at different sintering temperature (700°C, 900°C, 1100°C, and 1300°C), under static air for 3 hours. X-ray diffraction, sintering behavior, optical microscope and brake down voltage were conducted. The maximum sintered density, brake down voltage and best homogenize microstructure were indicated for the compilation of MgO -20 WT % UBG ,sintered at 1300°C.

Keyword: Ceramic , Sintering , Brake down voltage .
PACS : 61

INTRODUCTION

The traditional powder ceramic process, often referred to as “press and sinter” [1], is constantly driven to change by an industry goal of entering new markets through substitution and the development of innovative products for new applications. Although much advancement has been made in the area of compaction, new materials [2], and sintering technology continue to broaden the applications and improve the overall quality and competitiveness of powder ceramic Component.

Due to the difficulty of Recycling the high cost of assembling and manufacturing requirements such as the removal of impurities and screening, as well as cheap raw materials used in industry such as sand and silica .However, the glass industry of sand is one of the industries, energy-consuming significantly, where you need the manufacturing process to temperatures up to (1600°C) the recycling of glass you need to heat energy much less. Glass is a material of more material interest in the world, which makes mainly of sand (silica), soda (carbonate of sodium) and lime (calcium carbonate) and of the glass many uses in various forms.

EXPERIMENTAL WORK

Analytical reagent grade MgO powder supplied by BDH Co., and the UBG test impurities listed in table number 1.

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TABLE 1. The impurities of MgO and used bulb glass.

No.	Item	Impurities	
1	Powder (95%) MgO	**Elements**	**Concentration (ppm)**
		Fe	349
		Ni	189
		Zn	5.9
		Mn	6.5
		Cu	13.3
		Cr	21
		Si	1224
2	Bulb glass powder	**Elements**	**Concentration (%)**
		Pb	0.017%
		Na	10.34%
		Ca	6.17%
		Si	27.3%
		Mg	1.64%
		Hg	0.25ppm

Pellets were fabricated without used bulb glass , and then powder for the 10wt% , 15wt% and 20wt% UBG-MgO specimens were prepared by dry mixing 5g of each was compacted of 4mm thickness ,The investigation involved the sintering temperature from (700 – 1300)°c in static air for socking sintering time 5 hours. Densification measurements were based on the volume determined and accurate weight. X-ray diffraction analysis was performed for the sintering specimens. The patterns obtained were analyzed and the high of the x-ray diffraction peaks was used to represent the phases formed according to the ASTM. Optical micrographs were conducted for sintering specimens. The electrical insulation behavior was tested by measuring the brake down voltage for the sintering ceramics compacts under applying high voltage rang.

RESULTS AND DISCUSSION

Standard x-ray diffraction technique was used to determine the crystalline phase present in the fabricated bodies. For all compacts sintered at 1300°c , the major phases detected are related to the used bulb glass with a minor phase of MgO was indicated from the high intensity reflection at 2Θ (deg)=42° as shown in fig.1.

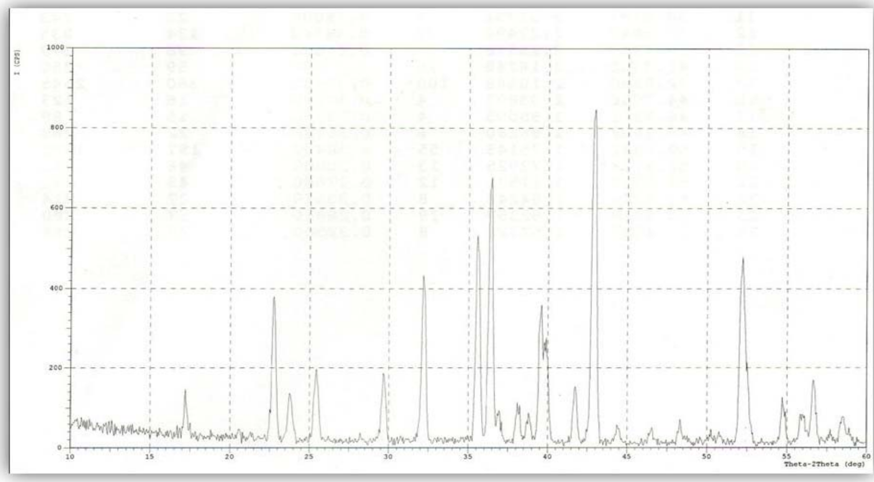


FIGURE 1. X-ray diffraction pattern for MgO –UBG 20 wt% compact sintered at 1300 °C in air.

Figure 2 shows the density of ceramic compacts MgO with and without UBG wt% sintered at various temperatures in air, up to some temperature the density is essentiality constant. Densification up to this point from 900°C to 1100°C is corresponds to the initial stage of sintering [3]. Above the critical relative densities which are approximately (6 -6.5gm/cm^3) densification corresponds to the intermediate stage of sintering. While the sintered density of the MgO-UBG showed a rapid increasing at all sintering temperature reaching its maximum value for the 20 wt% UBG (final stage) of (7.40 g/cm^3) at 1300°C.

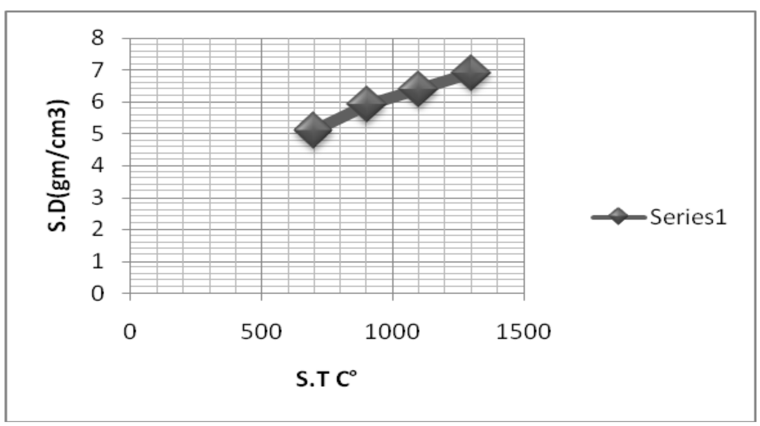
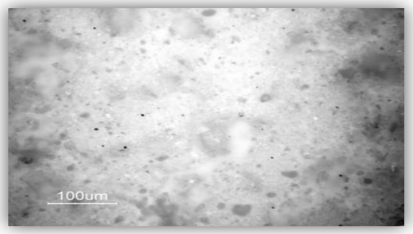


FIGURE 2. Sintered density of MgO –UBG compacts sintered at different sintering temperature in air

The micro structural examination of the ceramics compacts showed for samples sintered at 700°C and fig. 3a the compact containing UBG 20wt%, showed evidence of the coarse 150 µm porous. Whereas the same compact sintered at 1300°C showed evidence of fine 100 µm porous, (fig. 3b). However clear differences were found in size and location of the porosity for the MgO-UBG sintered compacts, it seems that the MgO powder tend to shrink away during sintering process providing numerous fine and coarse pores [4].



(a) **(b)**

FIGURE 3. Microphotographic of MgO- UBG20wt% sintered at (a) 700°C and (b) at 1300°C

Figure 4 shows the brake down voltage at the MgO with and without UBG content sintered at different sintering temperature in air . For all the sintered compacts it were observed that the voltage resistance against braking steadily increased reached a maximum value of (6.90kv/mm) for the compact MgO – UBG 20wt% sintered at 1300°C, comparing with the matrix MgO of value (4.20kv/mm) which be consistent with the sintered densities (sintering behavior) [5], for all weights percentage used.

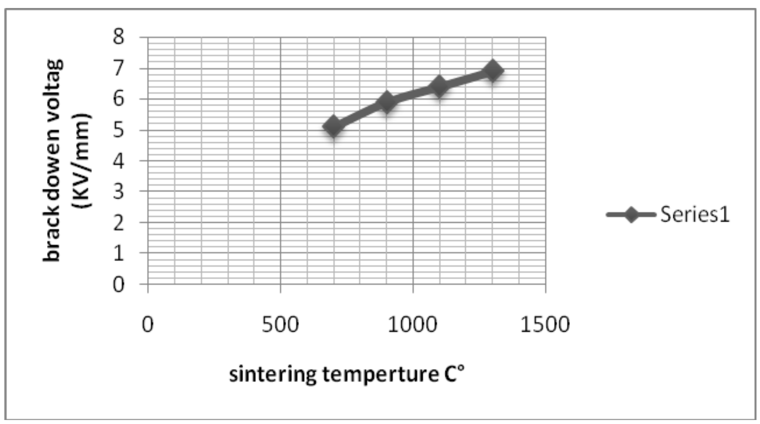


FIGURE 4. The brake down voltage of MgO-UBG 20 wt% sintered at different sintering temperature in air

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