

## 열분석에 의한 $\text{SiO}_2\text{-Na}_2\text{O-CaO}$ 유리의 결정화 고찰

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이온전도 유리인  $50\text{SiO}_2\text{-}40\text{Na}_2\text{O}\text{-}10\text{CaO}$ 에 대하여 결정화온도영역에서의 전기전도도에 대한 결정화의 영향을 알아보기 위하여 differential thermal analysis(DTA)를 이용한 결정화 속도론을 연구하였다. 용융법으로 제조된 유리를 분쇄하여, 325mesh이하의 분말에 대하여 승온속도를 5, 10, 15, 20°C/min으로 달리하면서 DTA를 측정하였다. 결정화에 대한 활성화에너지와 kinetic parameter는 DTA 곡선으로부터 계산하였다. 최대 결정화 온도( $T_p$ )는 승온속도에 비례하였으며, 계산된 활성화에너지는 55.08Kcal/mol, Avrami지수(n)는 약 1이었다. 이는 결정상이 1차원적이며, needle형상이 우세하다는 것을 의미한다. X-ray diffraction으로 분석결과, 결정상은  $\text{Na}_4\text{Ca}(\text{SiO}_3)_3$ 로 분석되었다.

**Keywords:** crystallization kinetics,  $\text{Na}_4\text{Ca}(\text{SiO}_3)_3$

## Kinetics of crystallization in $\text{Li}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2$ (LAS) Glass System by thermal analysis

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This paper presents results and observations obtained from a study of crystallization behavior in  $\text{Li}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2$  (LAS) glass powders. Variable kinetic parameters have been obtained in order to investigate the crystallization behavior by using non-isothermal differential thermal analysis. LAS glass powders including  $\text{B}_2\text{O}_3$  which induce a low firing process have been melted and crushed to obtain coarse and fine glass powder. In case of coarse particles with  $88\mu\text{m}$ , the crystallization have been started at  $649\sim 699^\circ\text{C}$ , the crystallization of fine particles with  $< 44\mu\text{m}$  have been observed at  $640\sim 684^\circ\text{C}$  according to heating rate. In order to obtain the activation energy of crystallization ( $E_c$ ) and Avrami constant (n), Kissinger and Ozawa equations have been used. From several plotting, we have calculated that the average activation energy of crystallization in  $\text{Li}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2$  (LAS) glass was 49.31 kcal/mol by Kissinger equation and Avrami constant (n) was 1.45. Finally, we have concluded that the glass powder of  $\text{Li}_2\text{O-Al}_2\text{O}_3\text{-SiO}_2$ , have crystallized primarily by surface crystallization. Also, we have seen a clear indication of this result from SEM (Scanning Electron Microscopy) results.

**Keywords:** Crystallization Kinetics, Crystallization, LAS glass, Sintering.