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SYNTHESIS OF NIOBIUM DOPED ZINC BOROSILICATE GLASS-CERAMICS

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Summary

- Objectives
- Materials and methods
- Results
- Conclusions

Objectives

- Synthesis of the glasses Nb-ZBS
- Study of the effect of Nb_2O_5 addition:
 - glass transition and crystallization temperatures
 - crystalline phase formation
 - microstructure



Main applications

- Transparent Nb doped ZBS glasses and glass ceramics have photoluminescent behaviour.
- Glass-ceramics based on Nb doped ZBS have interesting dielectric characteristics.



Materials and Methods

Mixing the reagents

Name	%mol SiO ₂	%mol B ₂ O ₃	%mol ZnO
1S	10	30	60
2S	20	20	60

Melting

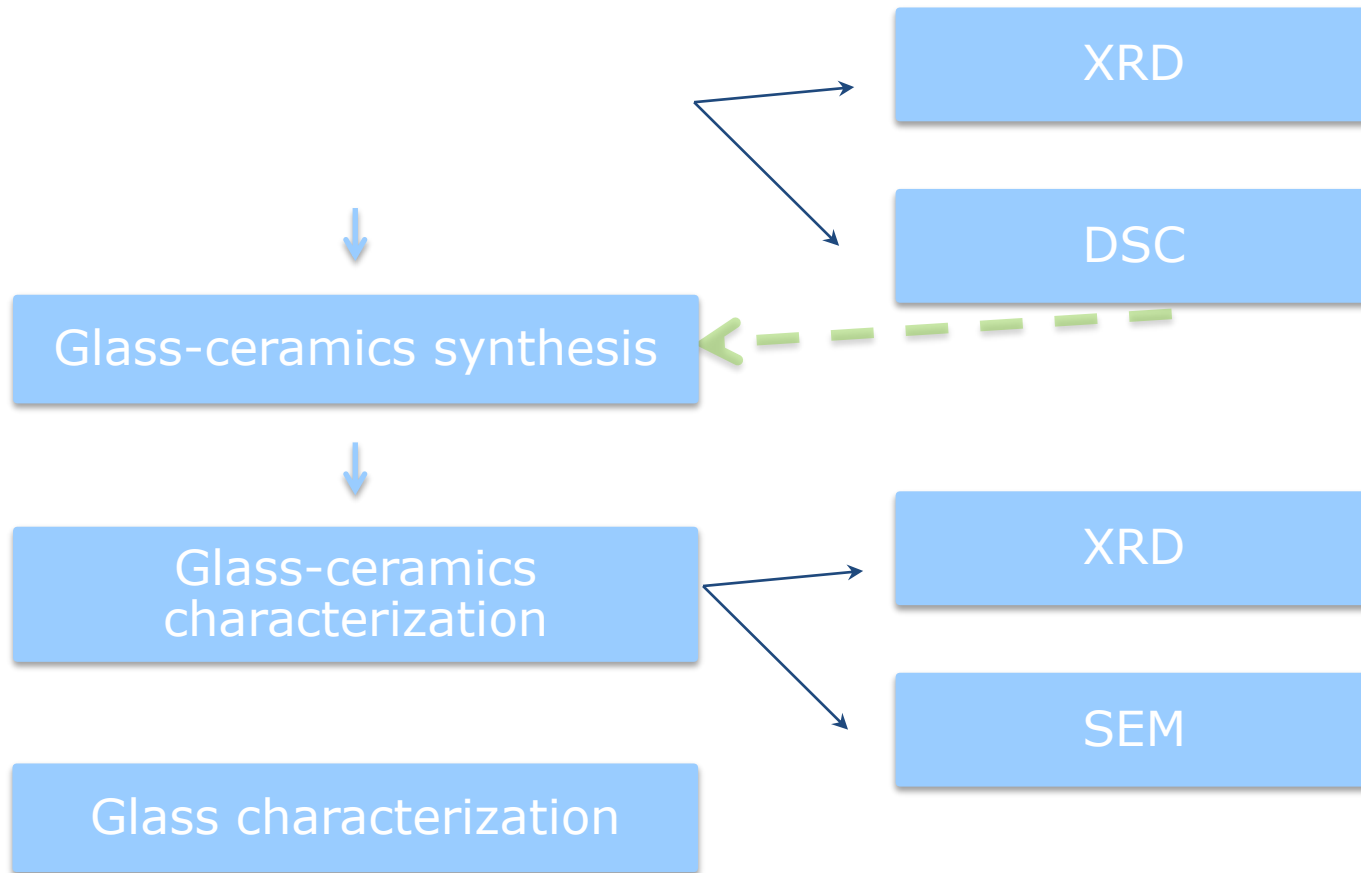
Name	Vel. (°C/min)	Temp. (°C)	Time (min)	%mol Nb ₂ O ₅	
	10	1350	120		
1S-0	0			2S-0	0
1S-2.5	2.5			2S-2.5	2.5
1S-5	5			2S-5	5
1S-7.5	7.5			2S-7.5	7.5
1S-10	10			2S-10	10

Pouring and annealing

Glass characterization

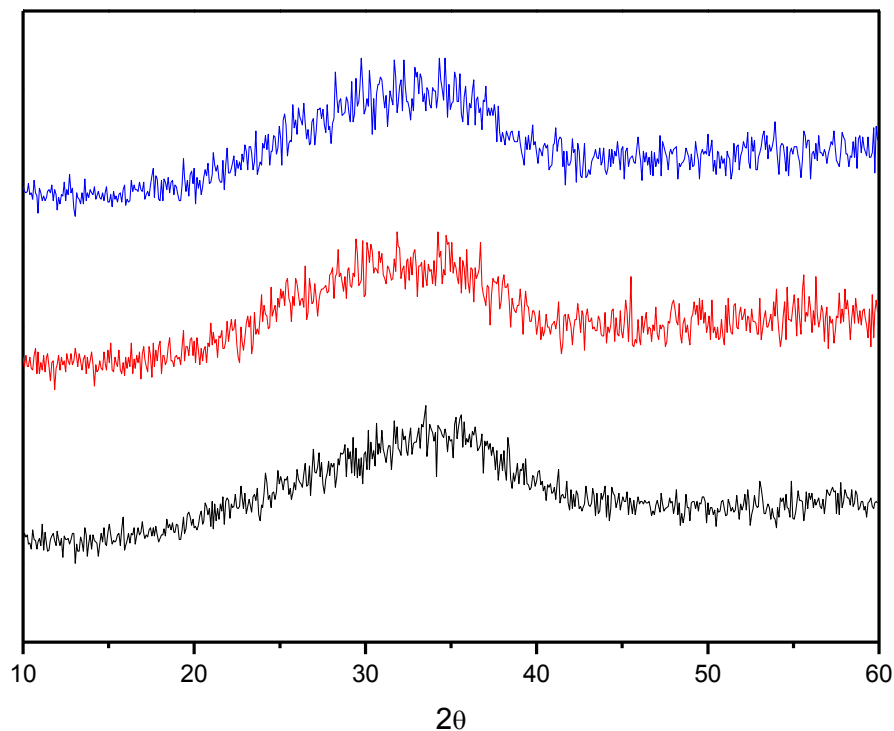


Materials and Methods





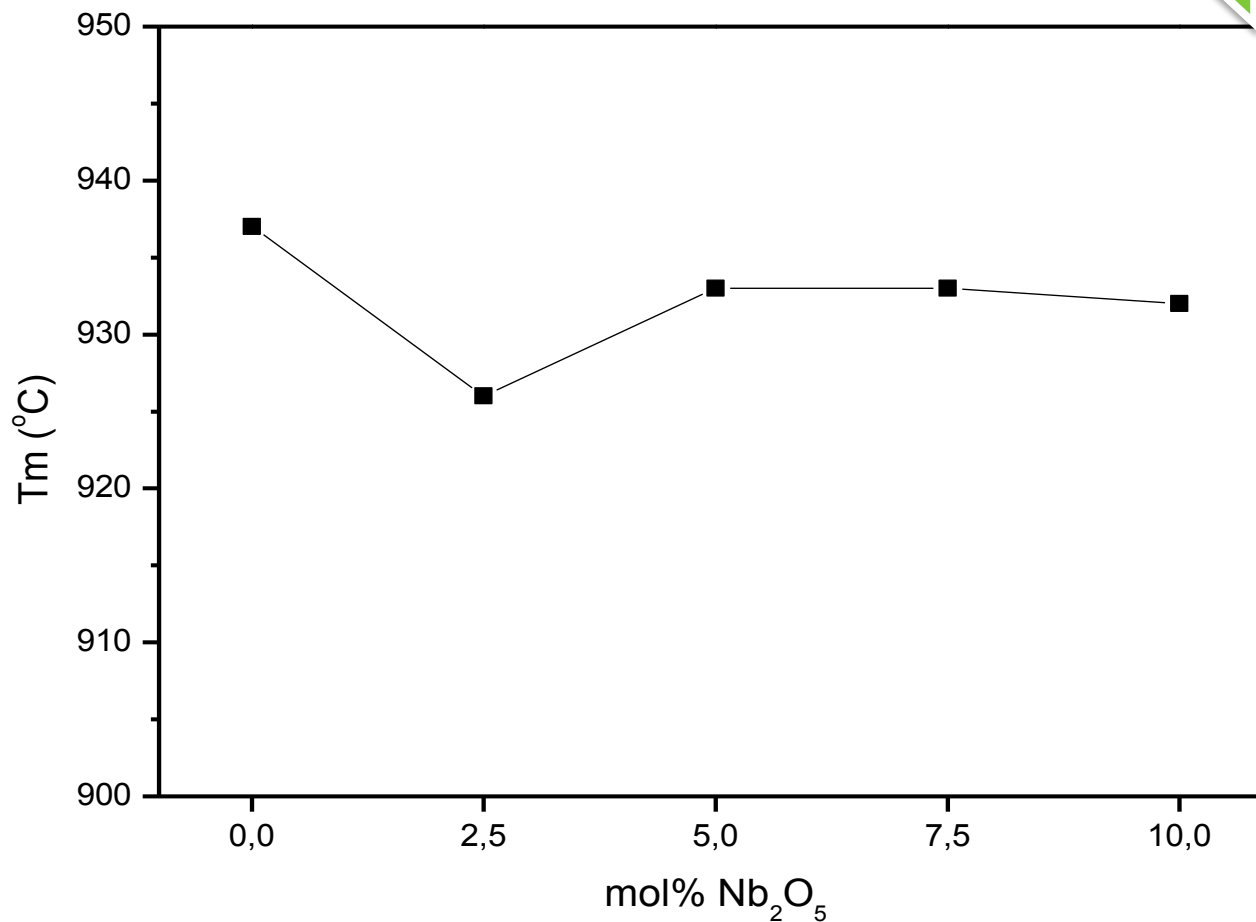
Results – XRD of glasses



Representative XRD patterns of the glasses

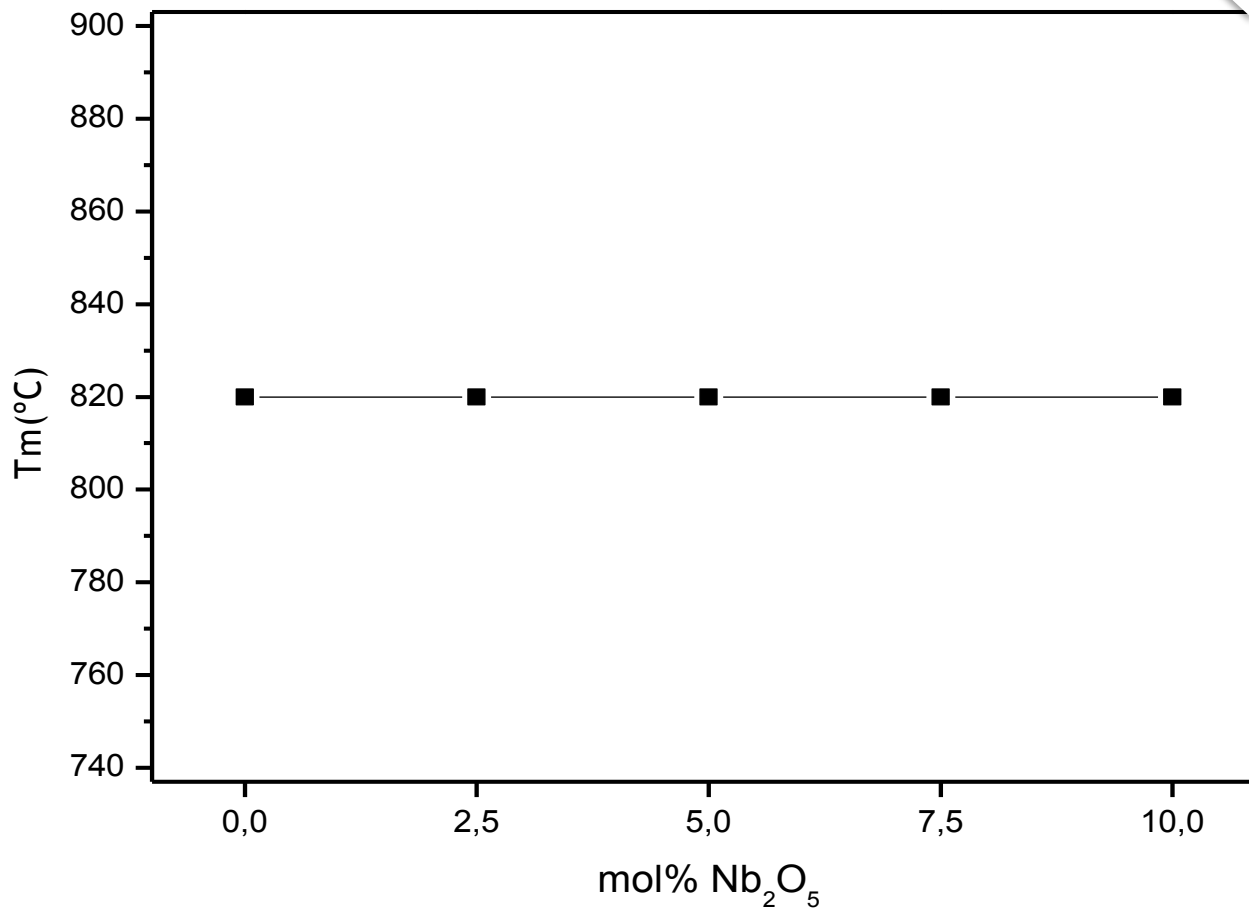
Results – DSC of glasses

Series 1S

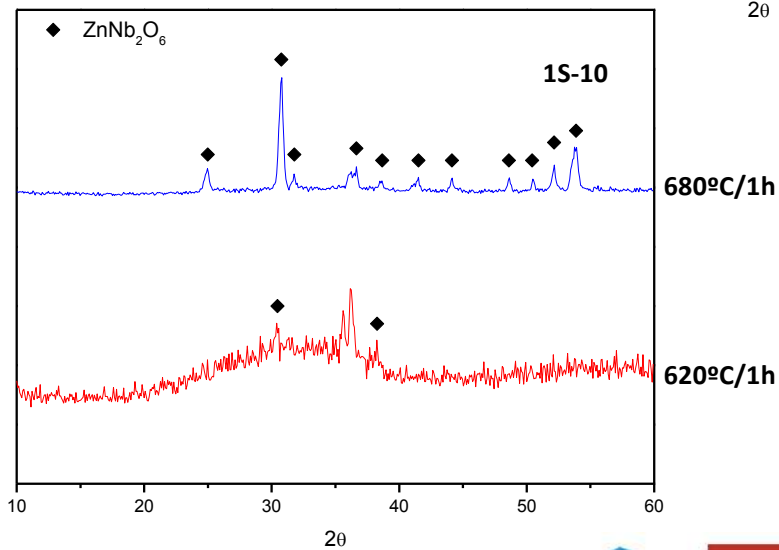
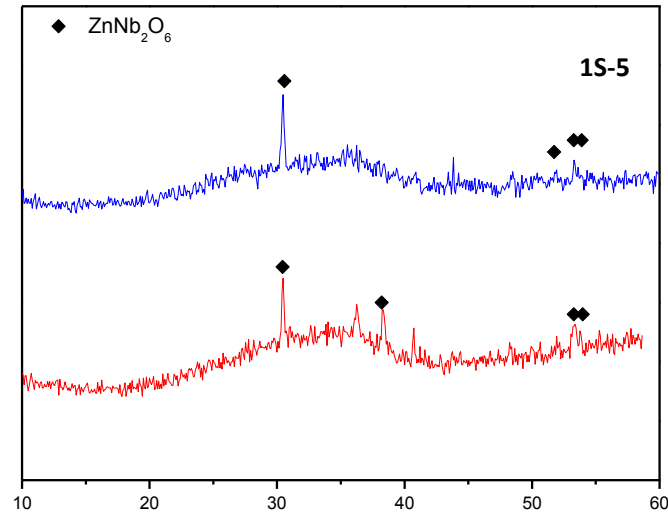
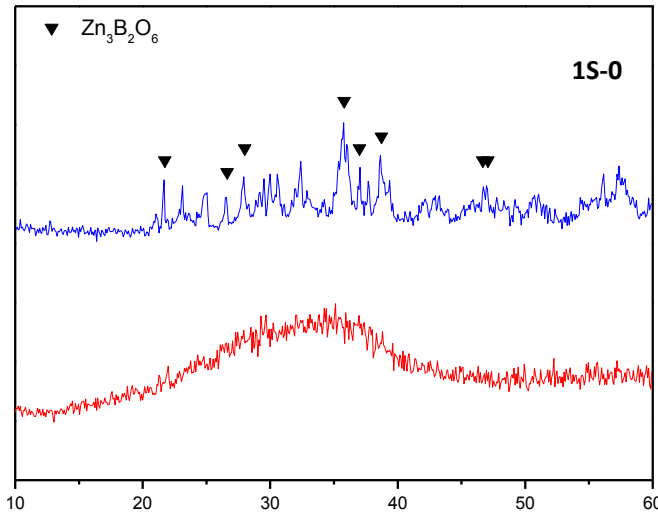


Results – DSC of glasses

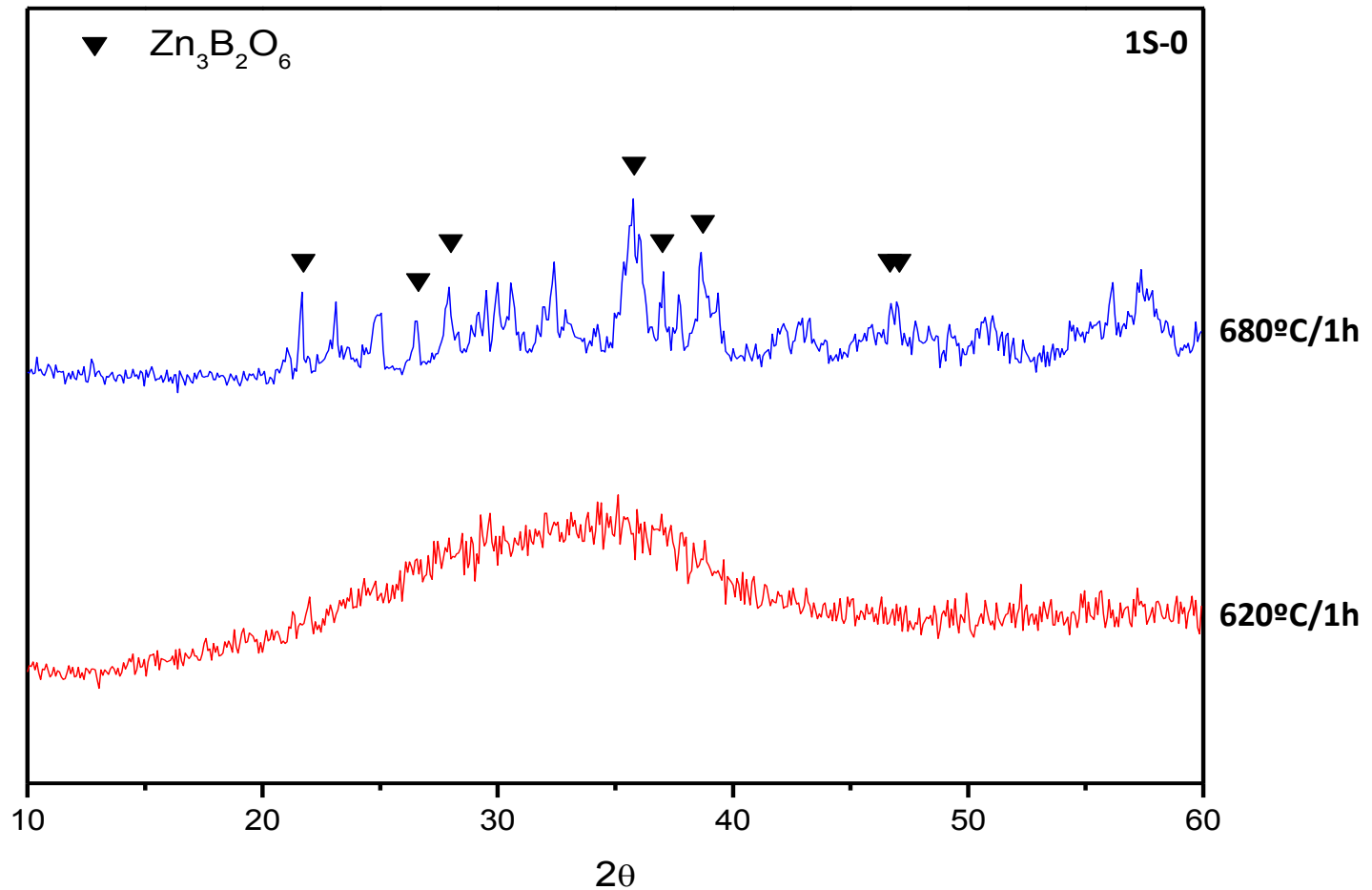
Series 2S



Results – XRD of glass-ceramics

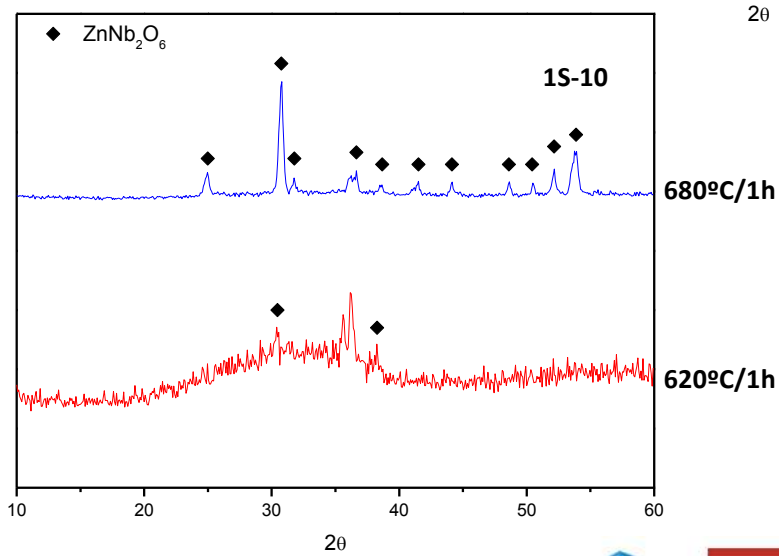
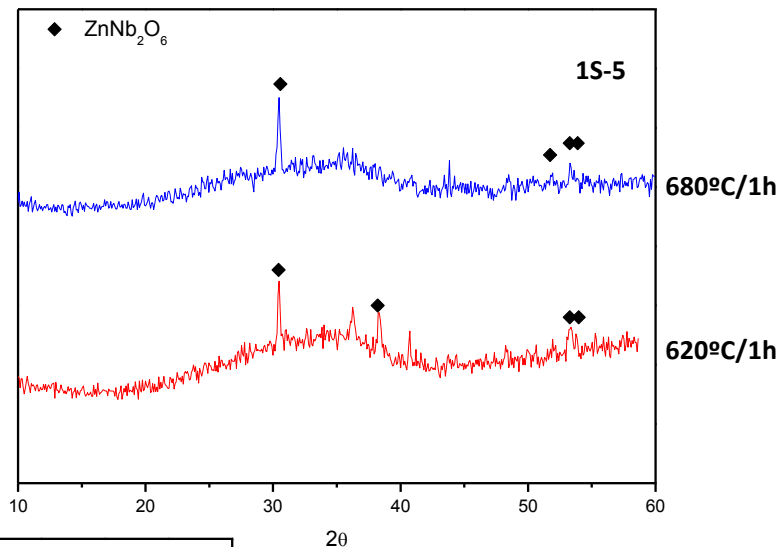
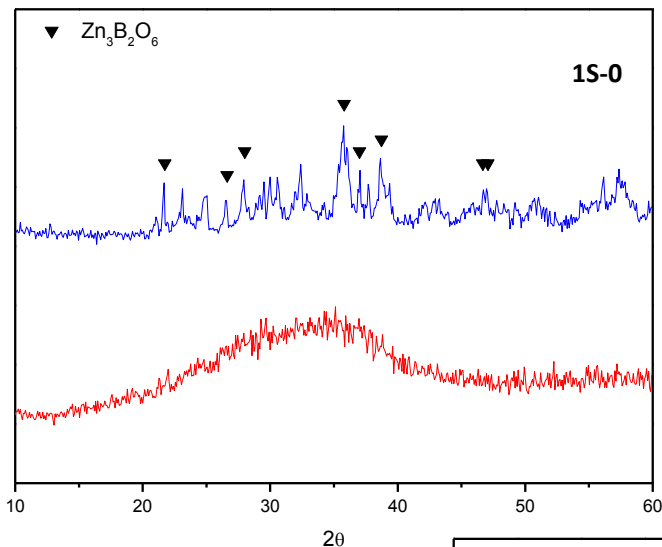


Results – XRD of glass-ceramics

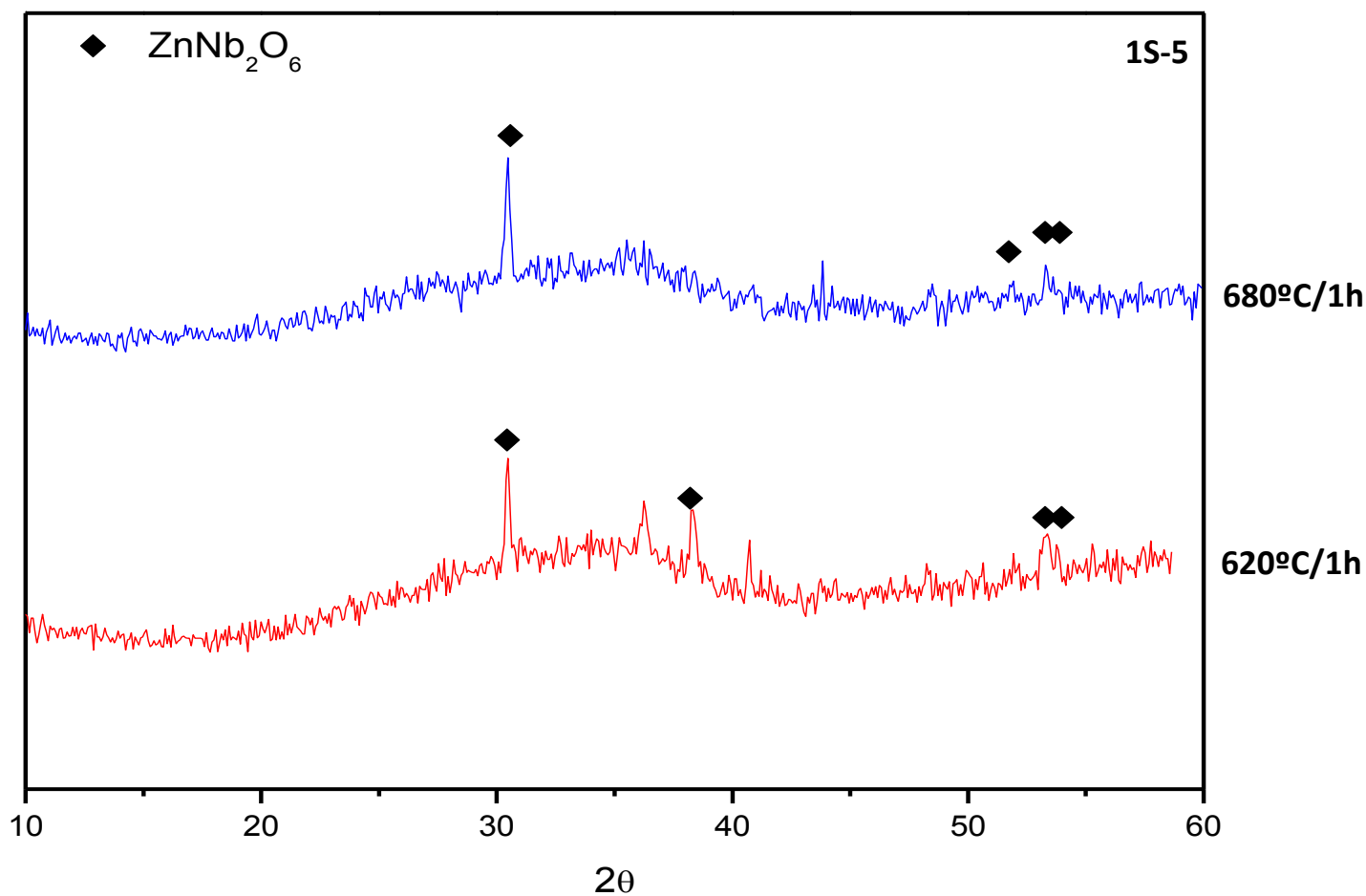




Results – XRD of glass-ceramics

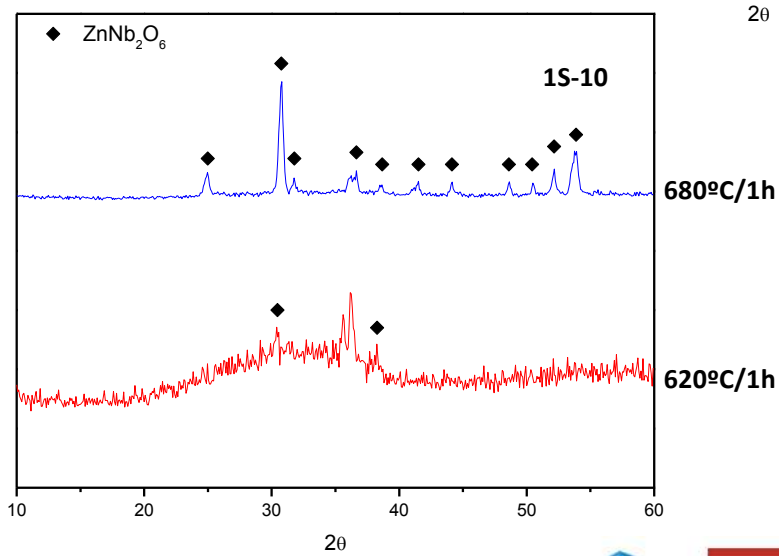
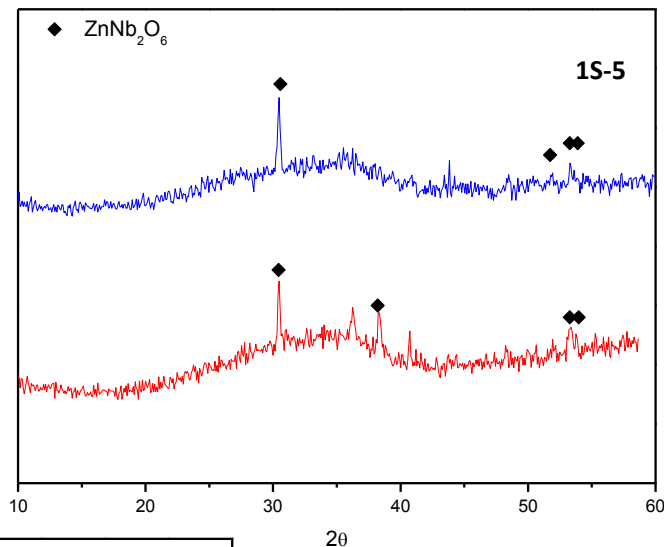
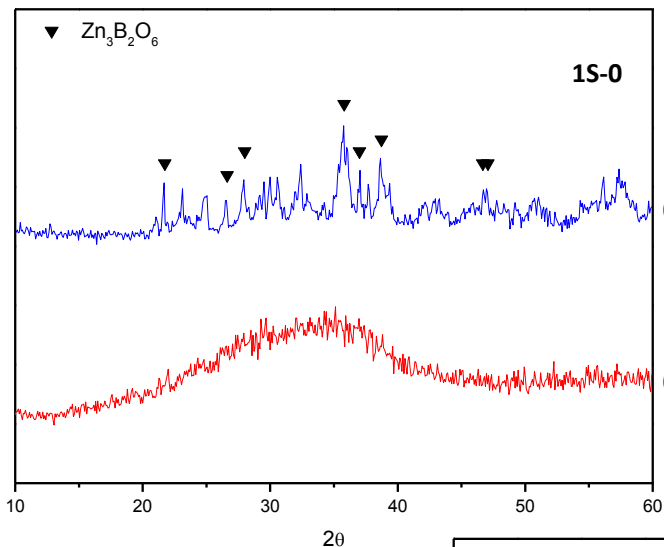


Results – XRD of glass-ceramics

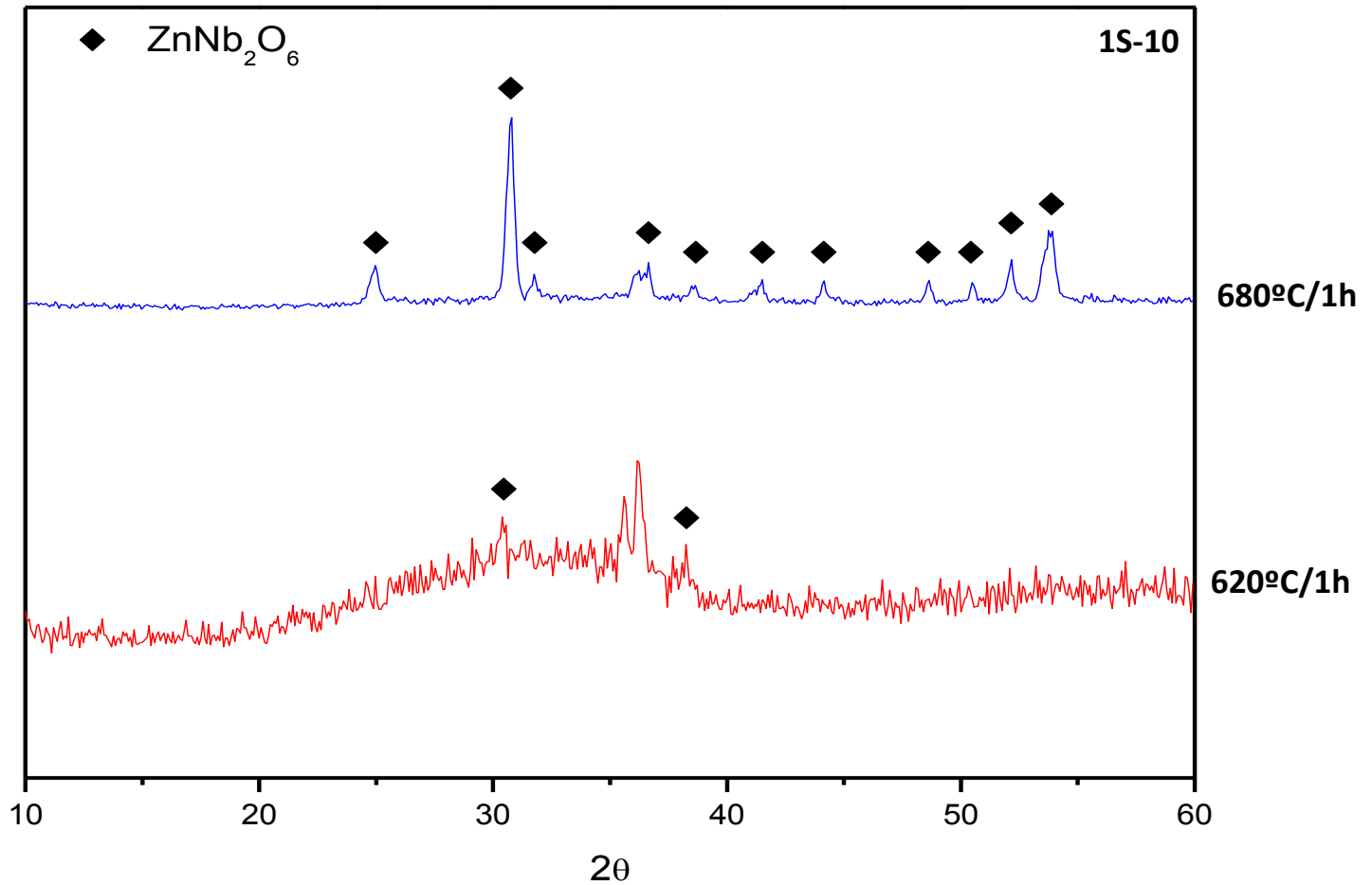




Results – XRD of glass-ceramics



Results – XRD of glass-ceramics





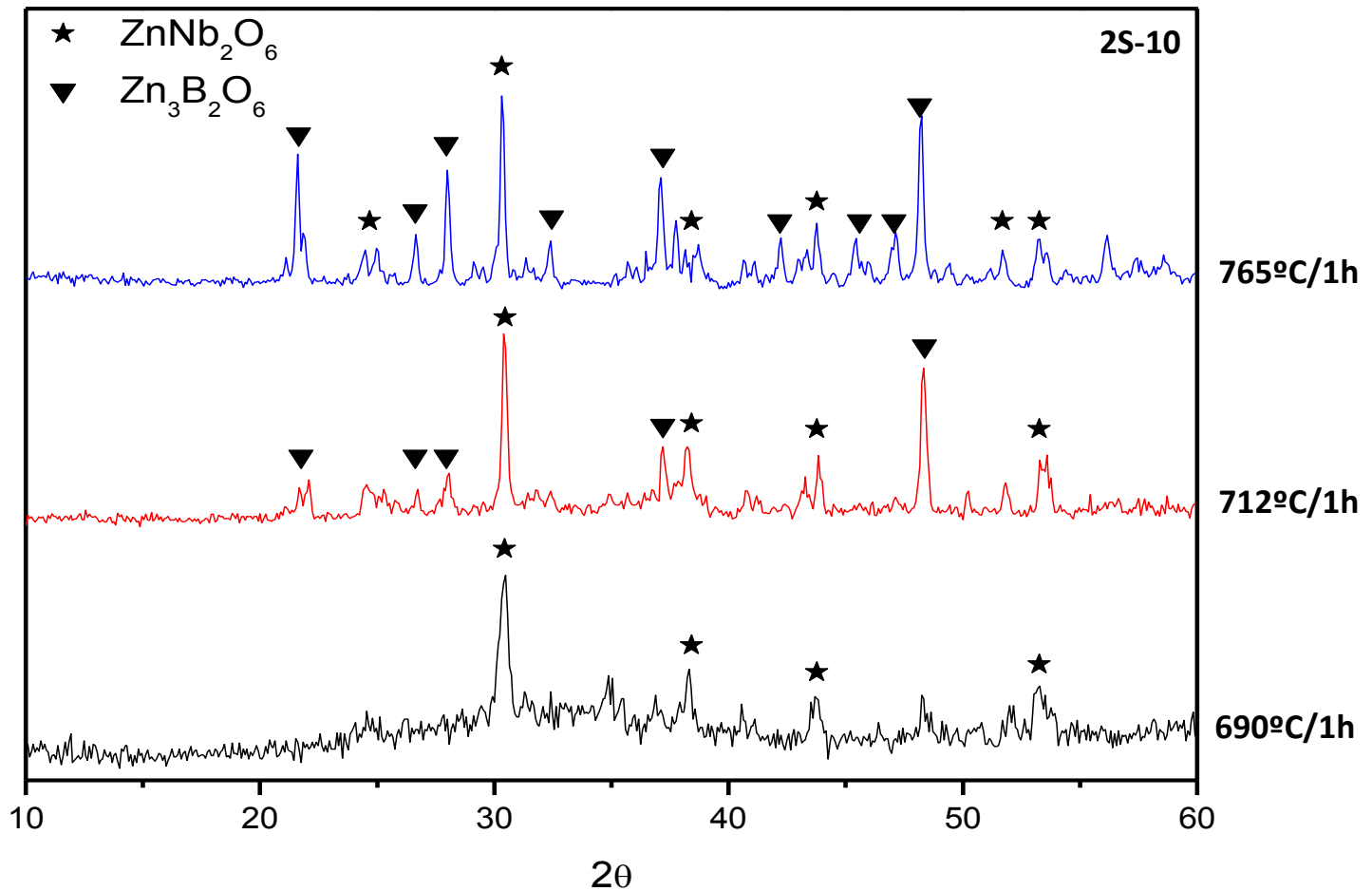
Results – phase formation

Nb_2O_5 →

%mol Nb_2O_5	620 °C	680 °C
0	-	$\text{Zn}_3\text{B}_2\text{O}_6$
5	ZnNb_2O_6	ZnNb_2O_6
10	ZnNb_2O_6	ZnNb_2O_6



Results – XRD of glass-ceramics





Results – phase formation

Temperature

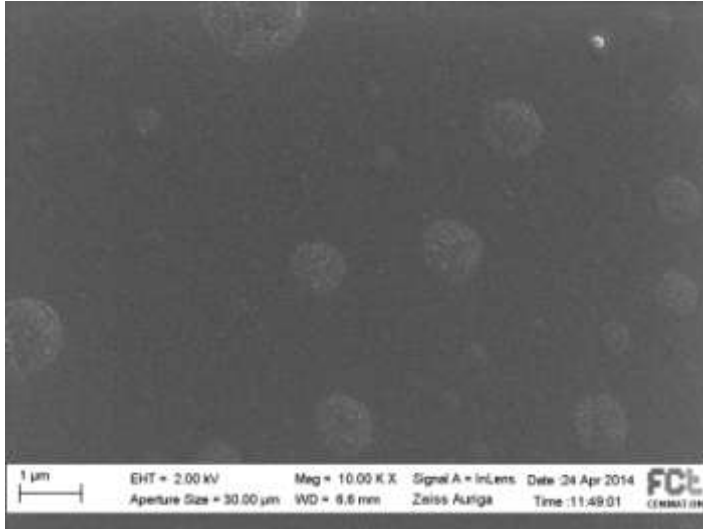


Temp. (°C)	Phase
690	ZnNb ₂ O ₆
712	ZnNb ₂ O ₆ /Zn ₃ B ₂ O ₆
765	ZnNb ₂ O ₆ /Zn ₃ B ₂ O ₆

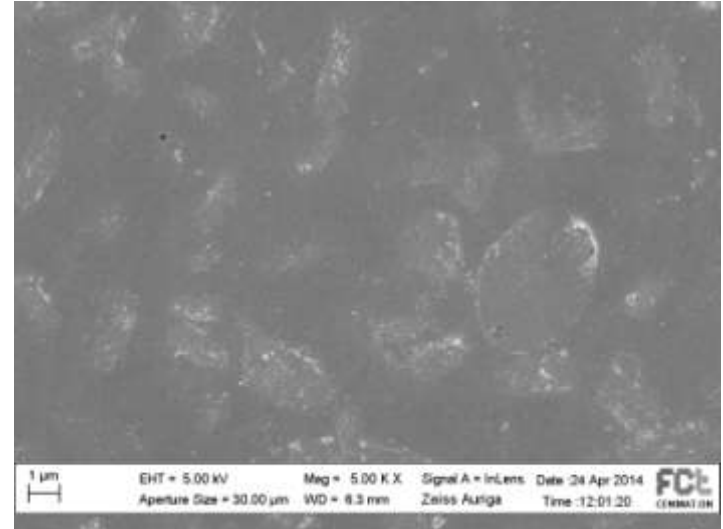




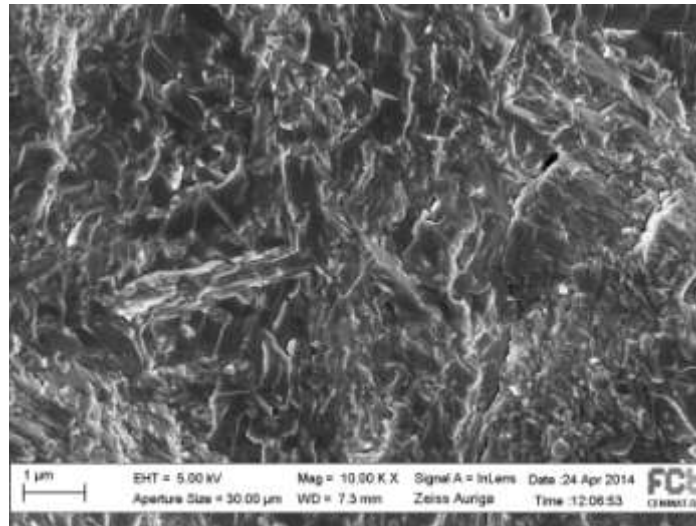
Results – SEM of glass-ceramics



690°C/1h



712°C/1h



765°C/1h



Conclusions

- The Nb_2O_5 addition causes:
 - decreasing of glass transition;
 - decreasing of crystallization temperatures;
 - formation of Zinc Niobate (ZnNb_2O_6) as the predominant phase and Zinc Borate ($\text{Zn}_3\text{B}_2\text{O}_6$) as secondary phase;
- In order to obtain nanostructured glass-ceramics Nb_2O_5 addition should be <5 mol% and the thermal treatments should be under 620°C .



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Thank you.