



PROJECT "THEORY AND APPLICATIONS OF SINTER-CRYSTALLIZATION" DN 19/7

**Understanding the mixed-alkali and alkaline-earth effects on the sinterability of
bioactive glasses**

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Abstract: Bioglass 45S5 is widely known for its ability to regenerate bone tissue. However, this glass cannot be fully densified by viscous flow due to its very high crystallization tendency. In this work, we evaluate the sintering behavior of two sets of compositions based on Bioglass 45S5. In the first (i) Na₂O is incrementally replaced by K₂O, whereas in the second (ii) CaO is replaced by MgO. All compositions were systematically analyzed by hot stage microscopy – HSM, DSC, viscosity and XRD measurements. Our sintering tests demonstrated that the densification of Bioglass 45S5 powders could be significantly enhanced with these compositional changes due to a decreased crystallization tendency. The mixed alkali effect (MAE) and mixed alkaline-earth effect (MAEE) were evidenced in both cases. However, the substitution of CaO by MgO was more effective in improving the densification rate. Finally, a new sinterability parameter (S_{LT}) was developed and successfully used to compare the distinct compositions. These results are very relevant for this particular glass and also for the design of novel bioactive glasses with improved sinterability.