

# The Structure of Gallium Phosphate Glasses

## by High-energy X-ray Diffraction

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X-ray diffraction experiments are used to obtain short-range order information of gallium phosphate glasses of meta- and pyrophosphate compositions. Parameters of the first-neighbor peaks, such as coordination numbers and distances, are obtained. A strong decrease of the Ga-O coordination number from  $6.0 \pm 0.2$  to  $4.6 \pm 0.2$  upon  $\text{Ga}_2\text{O}_3$  addition is found, which is accompanied by a shortening of the Ga-O distances. Only  $\text{GaO}_6$  octahedra exist at the metaphosphate composition. Close to the pyrophosphate composition, the majority of Ga atoms occupies already tetrahedral sites. The Ga-O coordination number behaves equivalent with the ratio  $M_{\text{TO}} = n(\text{O}_{\text{T}})/n(\text{Ga})$ , thus, with the number  $n(\text{O}_{\text{T}})$  of terminal oxygen atoms ( $\text{O}_{\text{T}}$ ) in phosphorus- $\text{O}_{\text{T}}$  bonds which are available for the coordination of each Ga atom. Thus, P- $\text{O}_{\text{T}}$ -Ga bridges are formed for all  $\text{O}_{\text{T}}$  atoms. The  $\text{GaO}_n$  polyhedra neither share  $\text{O}_{\text{T}}$  atoms nor form Ga-O-Ga bridges. With increasing fraction of  $\text{GaO}_4$  tetrahedra and decreasing lengths of the phosphate chains the network expands.

*Key words:* X-ray Scattering, Short-range Order, Phosphate Glasses.