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Phase stability and Transitions' mechanisms in MPO_4 compounds under high pressures

SURINDER M. SHARMA, Bhabha Atomic Research Centre, Mumbai, India

MPO_4 ($M = Al, Ga, In, B$) compounds exist in several tetrahedrally connected structures at ambient conditions. Our experimental and theoretical investigations show that pressure brings about systematic changes in the nature of polyhedral coordination. Unlike the structural analog SiO_2 most of MPO_4 compounds evolve through an intermediate $Cmcm$ phase before transforming to still denser phases in which even phosphorus is also octahedrally coordinated. Our investigations also reveal that over-pressure helps bypass the region of co-existence of parent and daughter phases implying a barrierless path for emergence of higher coordinated states. Results of several investigations have helped obtain a unified understanding of these compounds and will be presented.