Title:	Nanostructured metal borides: synthesis and their applications
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Abstract:	Nanostructured metal borides have attracted lots of researcher attention due to their wide application such as field emitters, scratchless/ultrahard coating, superconductivity, catalysis, anticorrosive coatings and ceramics materials. These exciting properties of metal borides generally arise due to the complex metal borides structure. In general, metal borides are generally synthesized via a solid-state borothermal reduction route. Based on a detailed literature survey, it has been observed that metal boride nanostructures have been synthesized in very adverse condition (either high temperature or under high vacuum). Therefore, in the present thesis, we focused on the new strategies to obtain binary as well as ternary nanostructured metal borides using chemical routes and investigate their properties at the nanoscale. Metal boride comprises boron with the less electronegative atom. Metal borides are classified into two main types: (a) boron rich borides (B: M>= to 4:1) and (b) metal-rich boride (B: M< to 4:1). Among the wide variety of metal boride, here we have attempted to stabilize metal borides of type AB_2 (A=3d-transition metals) and AB_6 (A=Rare earth metals). Further, we have explored the corrosion and field emission properties of these metal borides. The main aim of the present thesis is to design a new low-temperature synthesis process for the stabilization of metal diboride and metal hexaboride at ambient pressure. In the present thesis, metal hexaborides such as NdB_6, GdB_6, $La_xNd_{1-x}B_6$ and $La_xGd_{1-x}B_6$ (x=0.1, 0.2, 0.3, 0.4, and 0.5) has been synthesised. For the synthesis of these metal hexaboride, first their metal hydroxide has been synthesised using hydrothermal route. The as synthesised metal hydroxide precursors have been heated with sodium borohydride to obtained various composition of rare earth hexaboride. Further, the synthesised rare earth hexaboride has been coated over a silicon substrate and their field emission and air oxidation study properties have been explored. Further, an important material of metal-rich boride i.e. ZrB_2 has been synthesised. Here, for the synthesis ZrB_2, first nanostructured zirconia of size 10-15 nm has been synthesised using the hydrothermal route. Further, zirconia nanoparticles heated with elemental boron to obtained pure ZrB_2. The synthesised ZrB_2 has been coated over stainless steel substrate and their anticorrosive properties have been done studied.
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