High pressure properties of carbon and silicon clathrates

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We propose to review the high pressure properties of carbon and silicon clathrates. Group IV clathrates are open-framework sp^3 based structures allowing for the ultra-degenerated intercalation of donor or acceptor atoms. Their physical properties are both governed by the sp^3 tetrahedral bonding and by the guest-host interactions. In spite of the important topological differences with respect to their diamond analogues, many of the clathrate physical properties as their low compressibility [1] or their superconductivity [2] can be interpreted in a common framework. On the other side, we have to consider the particular geometrical constraints of the hypothetical carbon clathrate structure to understand its exceptional ideal strength [3] that surpasses the one of diamond. The clathrate endohedral type of intercalation gives rise to the observation of a number of unique behaviours. We can underline the extreme high pressure stability [4], which can attain up to 4 times the one of the diamond phase for iodine intercalation, as well as their unique type of isostructural phase transformations [4,5].

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