

# Borate in Kaolinite Interface in Nano-phase

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**Abstract**—Total content of boron in soil and its availability to plants are constraint for crop production, despite fertilizer application. Nanofabrication with borate in clay mineral receptacle could conquer this situation. Therefore, we attempted to develop novel nanomaterials containing borate using kaolin. For this, bulk-kaolin was sonicated to obtain nano-kaolinite and reacted with borate ion in aqueous (pH 8) medium. However, no boron could be desorbed from the products discerning absence of bond formation with kaolin, which could otherwise have been facilitated on the positive charge sites of the octahedral sheet along 001 planes, and on dissociable hydroxyls on edges. The absence of bond between borate and kaolinite could be because of high charge and small ionic radius (0.02 nm) coupled with high ionization energy of boron that pushes protons on the outermost shells in  $B(OH_4)^-$  preventing complex formation with kaolin, despite boron's strong affinity of complexation reaction. It is suggested that greater separation of kaolin by decreasing zeta potential, knocking of proton from kaolin by manipulation of pH in the interface environment, and addition of chelating agents like native soil organic materials or, surfactants might bring the breakthrough in nanofabricating novel boron products.

**Keywords:** Borate, ionization energy, nanofabrication, nano-kaolinite.