

Dissolution kinetics of the annite – phlogopite system: A kinetic Monte Carlo approach

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Annite and phlogopite are the Fe- and Mg-rich end members, respectively, of the biotite mica group, representing one of the most common solid solution systems in nature. However, the importance of this series is not limited to geological sciences (e.g. [2]), as it has important industrial applications as well (e.g., as an additive in paints). Many experimental dissolution studies have investigated the influence of pH, temperature, or pO₂ with the main purpose of determining material fluxes with respect to specific mineral components (e.g. [3]).

In this study we present a mechanistic approach using kinetic Monte Carlo (KMC) simulations, adapting a model originally developed for muscovite [1]. A modified version implementing phlogopite [4] is further extended by an iron-magnesium exchange mechanism to investigate dissolution kinetics as a function of solid solution composition, results of which we then compare with experimental observations obtained from the literature. This study is thus a first step towards a more general treatment of the role of solid solution composition in phyllosilicate dissolution kinetics, potentially applicable to similar ion-exchange problems in clay minerals.

[1] Kurganskaya et Luttge (2013), GCA, 545-560, [2] Sugimori et al. (2009), GCA 73, 3767-3781, [3] Samson et al. (2005), GCA 69, 399-413. [4] Schabernack et al (2017), Kinetic Monte Carlo study on dissolution kinetics of different sheet silicate octahedral structures, Goldschmidt Conference contribution, *this volume*.