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Review

Carbon dioxide absorption into promoted potassium carbonate solutions: A review

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ABSTRACT

The emission of carbon dioxide into the atmosphere is recognized as a significant driver for climate change. Carbon capture and storage (CCS) techniques are efficient and effective ways to reduce these emissions to the atmosphere. However, the cost of any carbon capture technique has to be reduced to manageable levels before it can be deployed at an industrial scale. Several methods for capturing carbon dioxide, such as absorption, adsorption, membrane techniques and cryogenic separation have been proposed, of which absorption is the closest to commercial reality. Potassium carbonate is a good solvent for carbon dioxide capture because of its low regeneration energy, low degradation rates and low corrosivity. However, one shortcoming of potassium carbonate in CO_2 absorption is that it has relatively slow reaction kinetics with CO_2 resulting in the need for large absorption equipment. The most efficient method for improving the absorption kinetics is to add promoters into the potassium carbonate solutions. There have been a number of promoters studied over the last decades, including inorganic promoters such as arsenate, boric acid and vanadate, organic promoters such as different amines and amino acids, enzymatic promoters such as carbonic anhydrase and metal compounds mimicking carbonic anhydrase. In this paper, different promoters for CO_2 absorption in potassium carbonate solutions are reviewed and their performance summarized. Additionally, a CO_2 hydration promoting mechanism of deprotonation, followed by intermediate formation and then promoter regeneration is presented.

Contents

1. Introduction 29
 1.1. Reducing carbon dioxide from the atmosphere 29
 1.2. Techniques for carbon dioxide reduction 29
 1.3. Solvent absorption for capturing carbon dioxide 29
 1.4. Potassium carbonate system for carbon dioxide capture 29
 1.5. Changes associated with the potassium carbonate absorption process 30
2. Rate promoters for K_2CO_3 solutions 30
 2.1. Inorganic promoters 30
  2.1.1. Arsenite 30
  2.1.2. Boric acid 30
  2.1.3. Vanadate 31
  2.1.4. Other inorganic promoters 32
 2.2. Organic promoters 32
  2.2.1. Amines 32

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