Synthesis and Characterization of Microfibrous Media Supported K_2CO_3 for CO_2 Capture

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Current commercial CO_2 removal technology in the manufacture of ammonia and syngas utilizes aqueous K_2CO_3 solvent. However, the use of the solvent requires a large reactor volume. CO_2 capture capacity is enhanced while significantly increasing bed utilization efficiency and reducing overall system weight and volume by introducing microfibrous media. Microfibrous media bring advantages to the process by combining the use of small support particulates to promote K_2CO_3 utilization and the use of microfibers to promote high contacting efficiency and high accessibility of K_2CO_3 while minimizing the pressure drop. K_2CO_3 sorbents supported on high surface area activated carbon particulates (ACP) of 100-250 um (dia.) are prepared by pseudo-incipient wetness at different K_2CO_3 loading. The drying temperature is maintained around 100-120^oC. It is found that K_2CO_3 loading negatively correlates to K_2CO_3 utilization. An analysis of impregnated salt properties and their structural changes during CO_2 adsorption is investigated by x-ray diffraction spectroscopy (XRD). Based on XRD results, the presence of K_2CO_3 phase appears at K_2CO_3 loading of 30 wt.% as shown in Figure 1. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is then utilized to confirm the presence of K_2CO_3 at loading below 30 wt.%. The thermal stability and crystallization temperature at elevated temperature (35-

500^{o}C) are determined by differential scanning calorimetry (DSC) as shown in Figure 2. The surface morphology of sorbent surface is examined using scanning electron microscopy (SEM).

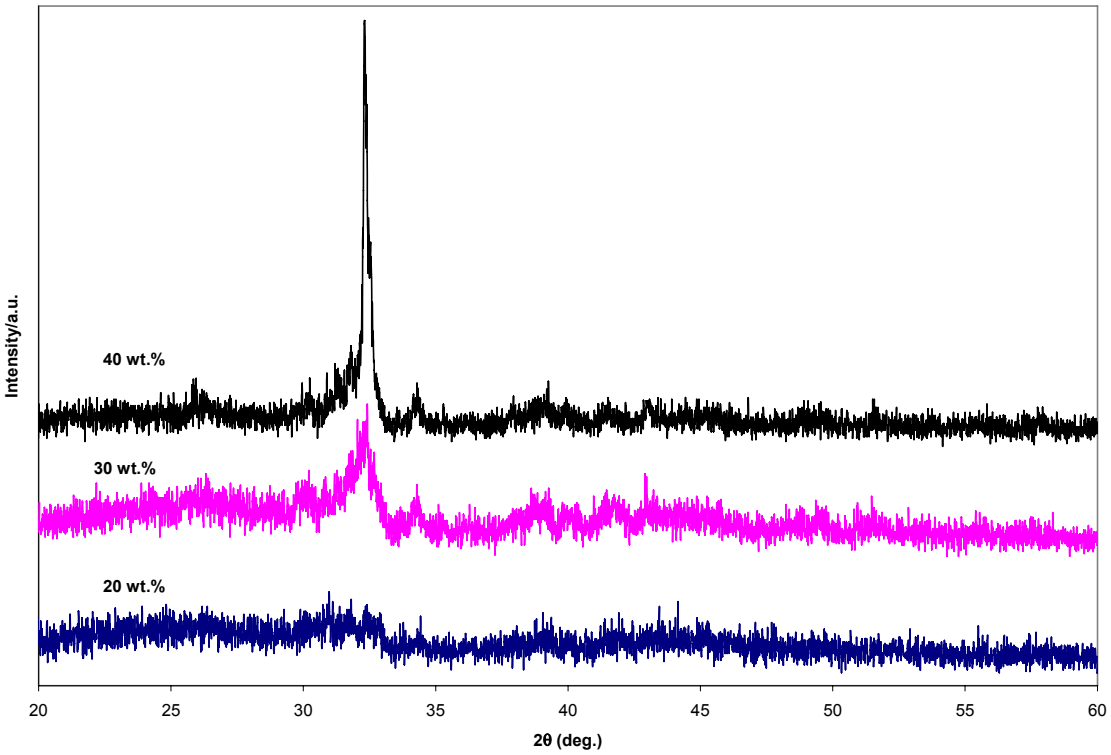

Figure 1: XRD patterns of various K_2CO_3 loadings on ACP

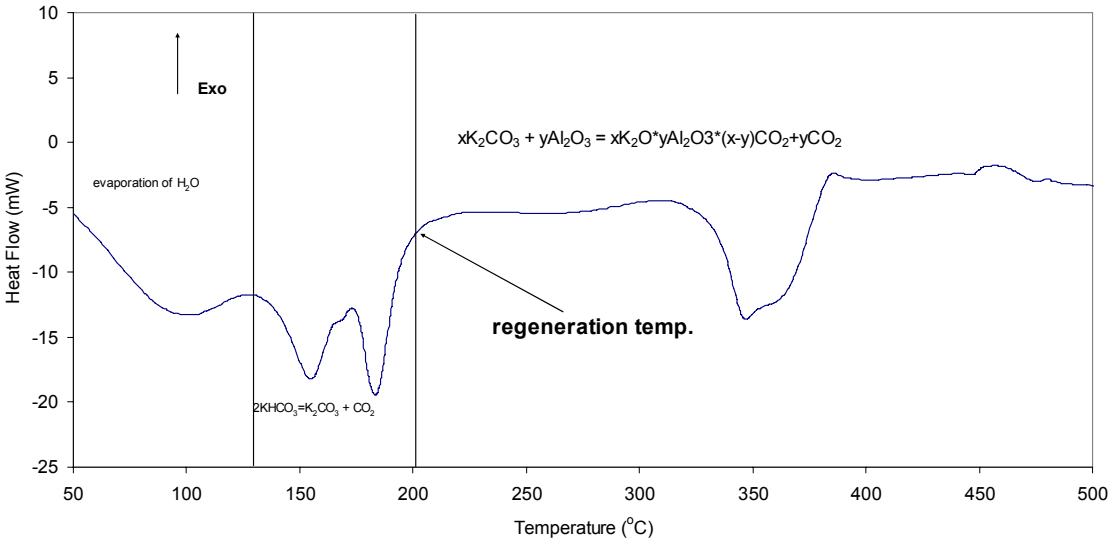

Figure 2: DSC spectrum for determination of regeneration temperature