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Supported Bicyclic Amidine Ionic Liquids as a Potential CO_2/N_2 Separation Medium

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ABSTRACT:
Five new room temperature ionic liquids were tested as supported ionic liquid membranes (SILMs) for CO_2/N_2 separation capability. This series of ionic liquids (ILs) contains bicyclic amidine cations of 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) or 1,5-diazabicyclo[4.3.0]non-5-ene (DBN) with small alkyl chain substituents. These ILs have been synthesized to examine the effects of cation structure on free volume. Relevant physical and chemical properties have been examined, including CO_2 solubility and viscosity. The relationship between fractional free volume and permeability of gases is explored, with an interesting note on solubility. Each cation was paired with two different anions: bis(trifluoromethanesulfonyl)imide and tetracyanoborate, for further investigation of the cation-anion interaction on SILM permeability and selectivity. Three of these new ILs have exceeded Robeson's upper bound for CO_2/N_2 gas separations.

KEYWORDS: ionic liquid, carbon dioxide, free volume, SILM

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