Magnetic Suspension Balance Study of Carbon Dioxide Solubility in Ammonium-Based Polymerized Ionic Liquids: Poly(p-vinylbenzyltrimethyl ammonium tetrafluoroborate) and Poly([2-(methacryloyloxy)ethyl] trimethyl ammonium tetrafluoroborate)

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A magnetic suspension balance is used to measure solubilities of carbon dioxide in polymers synthesized from ionic liquids: poly(p-vinylbenzyltrimethyl ammonium tetrafluoroborate) (P[VBTMA][BF_4] for short) and poly(1-(p-vinylbenzyl)-3-methyl-imidazolium tetrafluoroborate) (P[VBMI][BF4] for short) at 25, 50, and 75 ºC, and up to 180 bar. Comparison of our CO_2 solubility data for bisphenol-A polysulfone with literature data verified the accuracy of the magnetic suspension balance. Typical glassy behavior is observed for solubility data of all three polymer-C gas systems at low pressures (up to 15 bar); this behavior is modeled by a dual-mode sorption fit. At high pressures (up to 180 bar) and for each isotherm, the apparent solubility of the two ionic polymers approaches asymptotic values. Furthermore, the depression of the glass transition temperature is measured using a pressure DSC, revealing that each ionic polymer remains glassy when exposed to CO_2 at pressures up to 70 bar. Finally, it is worth noting that the CO_2 solubility in P[VBTMA][BF_4] is higher than that in bisphenol-A polysulfone at the same temperature and pressure.