**Ionic Liquid as an Efficient Promoting Medium for Fixation of CO₂:
Clean Synthesis of α -Methylene Cyclic Carbonates from CO₂ and
Propargyl Alcohols Catalyzed by Metal Salts under Mild Conditions**

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Synthesis and characterization of ionic liquid

The ionic liquids were synthesized using the methods described in previously published material¹¹ and stored in an exsiccator filled with KOH. For analysis of the resulting RTILs, NMR (¹H at 400 MHz) was used to determine the purity of each ionic liquid and ensure complete reaction (however, before NMR analysis, the majority of the water was removed from the RTIL by heating to 70 °C while on a vacuum line). Each ¹H NMR spectrum contained peaks corresponding to 1-alkyl-3-methylimidazolium cation and anion, and indicated no residual reactants. The chemical shifts (ppm, neat sample) for the ¹H NMR of [BMIm][PhSO₃] were assigned to the hydrogen atoms on the [BMIm]⁺ cation and [PhSO₃]⁻ as they are labeled in Figure 1 (CD₃COCD₃) and Figure 2 (D₂O). It worthy noted that the H peak in C2 of imidazolium disappeared in D₂O (Figure 2) but did not in CD₃COCD₃ (Figure 1), indicated the high activity of the H in C2 of imidazolium.

NMR of Ionic Liquid

Figure 1 ¹H NMR of [BMIIm][PhSO₃] obtained in CD₃COCD₃

Figure 2 H NMR of [BMIm][PhSO₃] obtained in D₂O

STANDARD 1H OBSERVE

[illegible]

Spectroscopic Materials of Product *b*

STANDARD 1H OBSERVE

```

exp5 s2pu1
SAMPLE
date Jul 8 2003 temp not used
solvent Acetone gain not used
file /export/home/~spin not used
Wang/vmr/sys/data/~spin 0.008
CPD=11.fid pps0 12.000
ORIGIN 1
ACQUISITION 6402.6
SW 3.744 11
at 47542 in n
np 4000 dp n
fb 1.006 hs PROCESSING nm
ds 1.002 fn not used
nt 32 DISPLAY
ct TRANSMITTER sp 343.5
tn H1 wp 1624.7
sfrq 400.162 rf1 790.6
cpd 3352 rf2 25.0
tpr 62 rf3 -13.9
pw DECOUPLER C13 WC 180
dn 0 SC 0
dof 0 mn 102
dm 44 t1 ph
dpr 44 nm
dmf 17034
  
```

Spectroscopic Materials of Product *c*

STANDARD 1H OBSERVE

```

exp6 szpu1
date Jul 9 2003 temp not used
vent cone gain not used
file export/data/~ not used
Wang/vmr/sys/data/~ hist 0.008
GVL-3-H1.fid pw90 12.000
ACQUISITION alfa 6.600
sw 6402.6 f1
rt 32.44 f1
ns 42942 in
fb 4000 dp
bs 16 hs
nt 1.000 fn
ct 32 not used
tn 32 DISPLAY 310.7
tp 32
sfrq 400.162 rf1 1881.0
tof 399.9 rfp 791.2
tpwr 62 fp 22.0
pw 6.000 lp -19.0
DECOUPLER C13 PLOT
do 180 wc 180
dof 0 sc 0
dm nnn vs 131
dmm c th
dpwr 44 nm
dmf 17094 ph

```