

# STABILITY STUDY OF MOF@IL COMPOSITE MATERIALS

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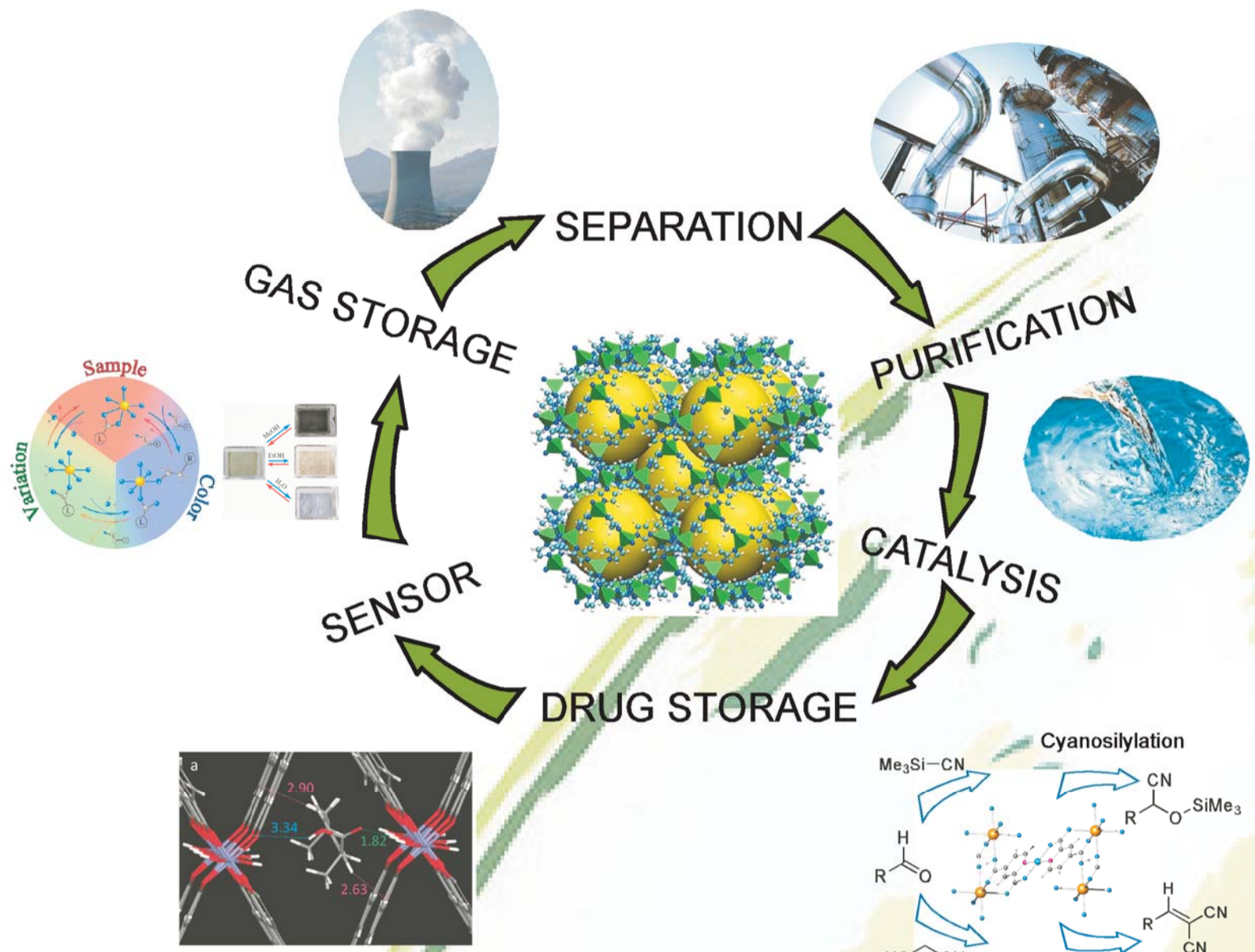
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## Metal-Organic Frameworks (MOFs)

Metal-organic frameworks (MOFs) offer unique advantages for many applications due to their ordered structures, high thermal stability, tunable chemical functionality, ultra-high porosity and the availability of hundreds of well characterized structures.[1]



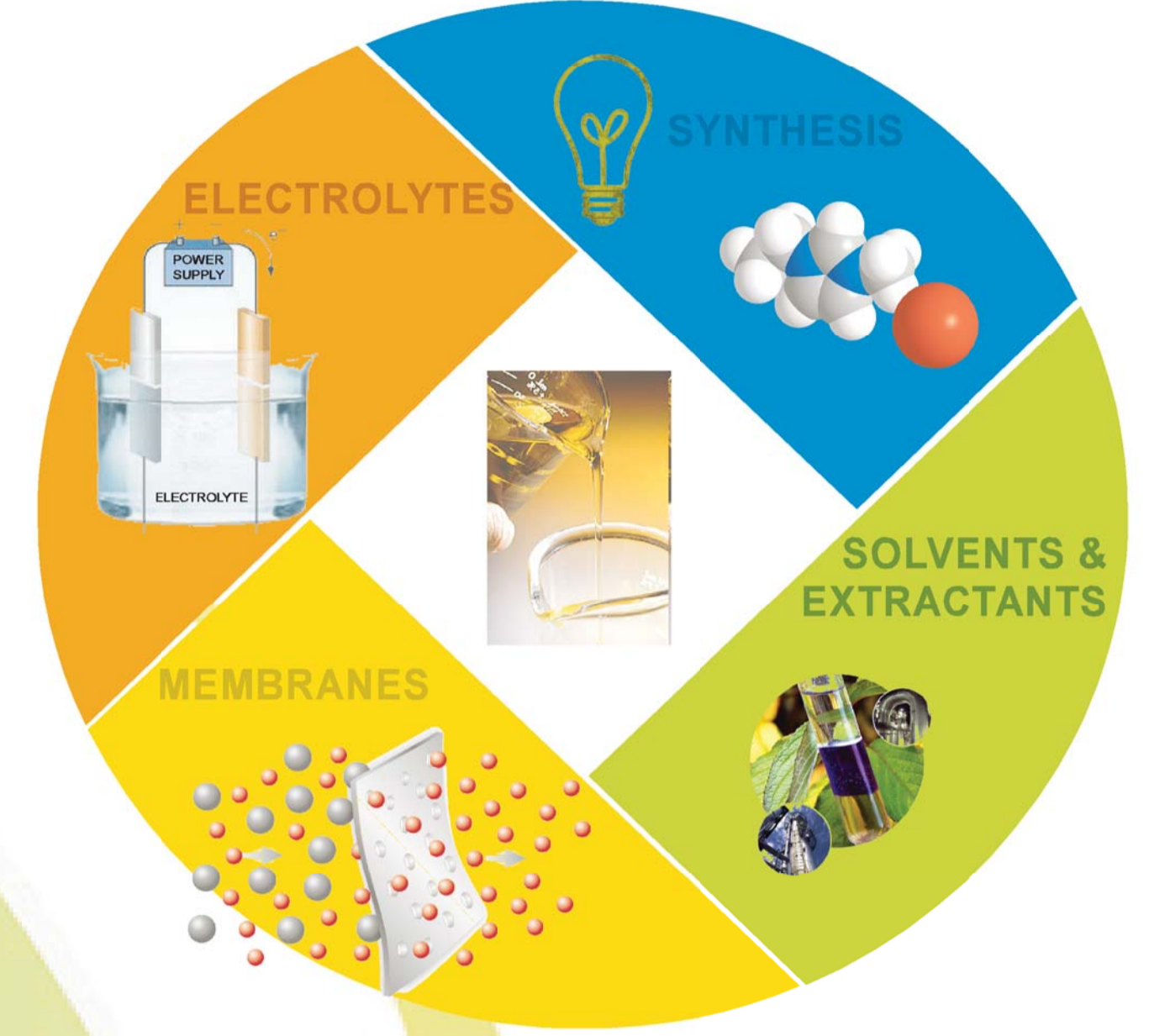
## MOF@IL Composite Materials

The insertion of ILs into MOFs has resulted in a new generation of materials with properties of both MOF and IL. [3] The studies of potential applications of MOF@IL composite materials are still very incipient, but they point out that the properties of MOFs could be improved by the insertion of ILs.[4]



## Ionic Liquids (ILs)

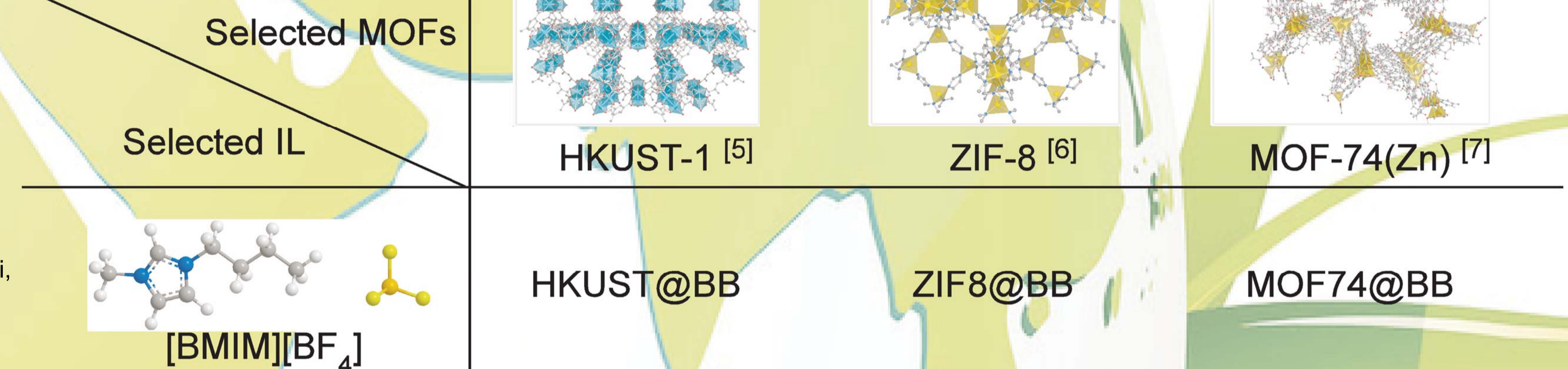
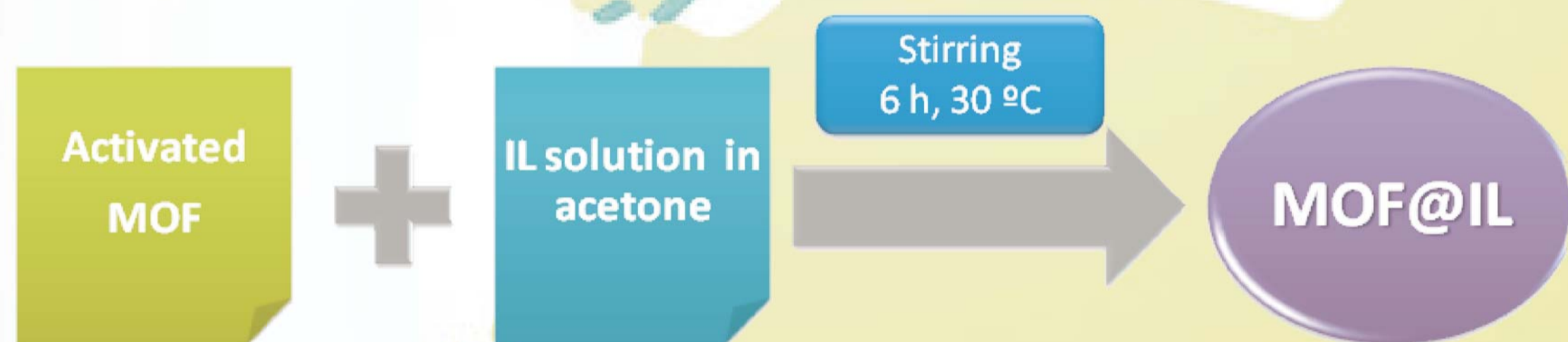
Ionic Liquids (ILs) have suitable properties for many applications, such as negligible volatility, non-flammability, high thermal and chemical stability, and high ionic conductivity. However, their liquid nature hinders their handling, making it necessary the use of solid supports. [2]



[1] J. Adams, D. Pendlebury, *Global Research Report Materials Science and Technology* (2011) Thomson Reuters; R. Zou, A. I. Abdeel-Fattah, H. Xu, Y. Zhao, D. D. Hickmott, *CrystEngComm*, **12**, 1337 (2010); [2] A. K. Cheetham, C. N. R. Rao, R. K. Feller, *Chem. Commun.*, **46**, 4780 (2006); S. Kitagawa, M. Kondo, *Angew. Chem. Int. Ed.*, **36**, 1725 (1997); S. M. Cohen, *Chem. Rev.*, **112**, 970 (2012); M. H. Alkordi, Y. Belmabkhout, A. Cairns, M. Eddaoudi, *IUCrJ*, **4**, 131 (2017); [3] K. Fujie, H. Kitagawa, *Coord. Chem. Rev.*, **307**, 382 (2016); [4] J. Wu, Y. Gao, W. Zhang, Y. Tan, A. Tang, Y. Men, B. Tang, *Appl. Organomet. Chem.*, **29**, 96 (2015); J. Tharun, K.-M. Bhin, R. Roshan, D. W. Kim, A. C. Kathalikkattil, R. Babu, H. Y. Ahn, Y. S. Won, D.-W. Park, *Green Chem.*, **18**, 2479 (2016); K. B. Sezginel, S. Keskin, A. Uzun, *Langmuir*, **32**(4), 1139 (2016).

## MOF@IL Preparation

Impregnation method was used to prepare MOF@IL composite materials

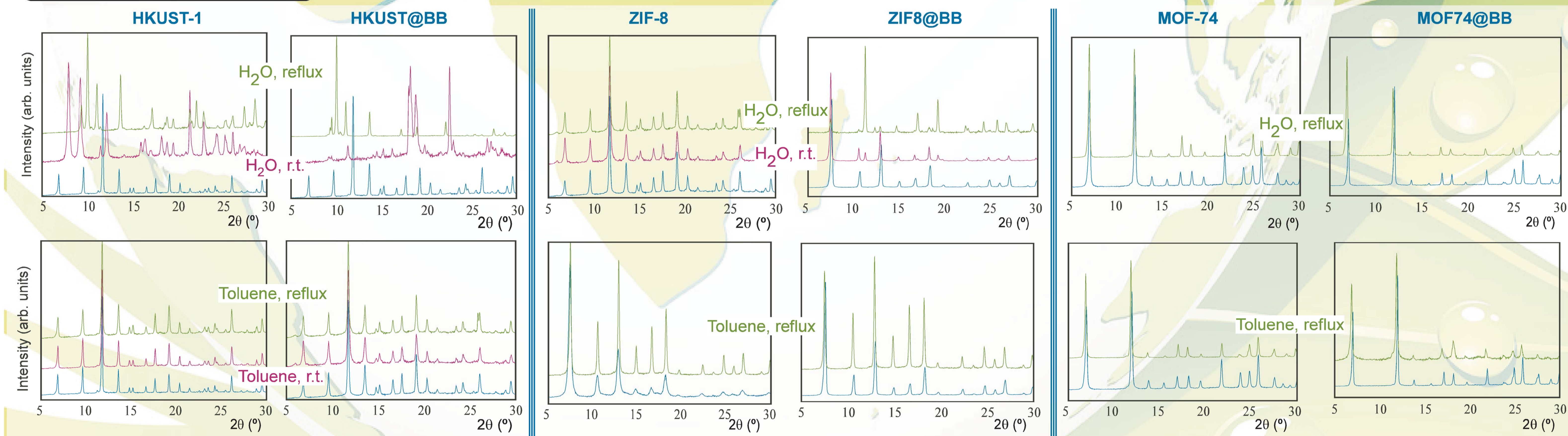


[5] S.S.-Y. Chui, S.M.-F. Lo, J.P. Charmant, A.G. Orpen, I.D. Williams, *Science*, **283**, 1148 (1999); [6] K. S. Park, Z. Ni, A.P. Côté, J. Y. Choi, R. Huang, F. J. Uribe-Romo, H.K. Chae, M. O'Keeffe, O.M. Yaghi, *Proc. Natl. Acad. Sci. U.S.A.*, **103**, 10186 (2006); [7] N.L. Rosi, J. Kim, M. Eddaoudi, B.L. Chen, M. O'Keeffe, O.M. Yaghi, *J. Am. Chem. Soc.*, **127**, 1504, (2005).

In order to know whether MOF@IL could be used as new materials it is necessary to study their stability, both thermal and chemical.

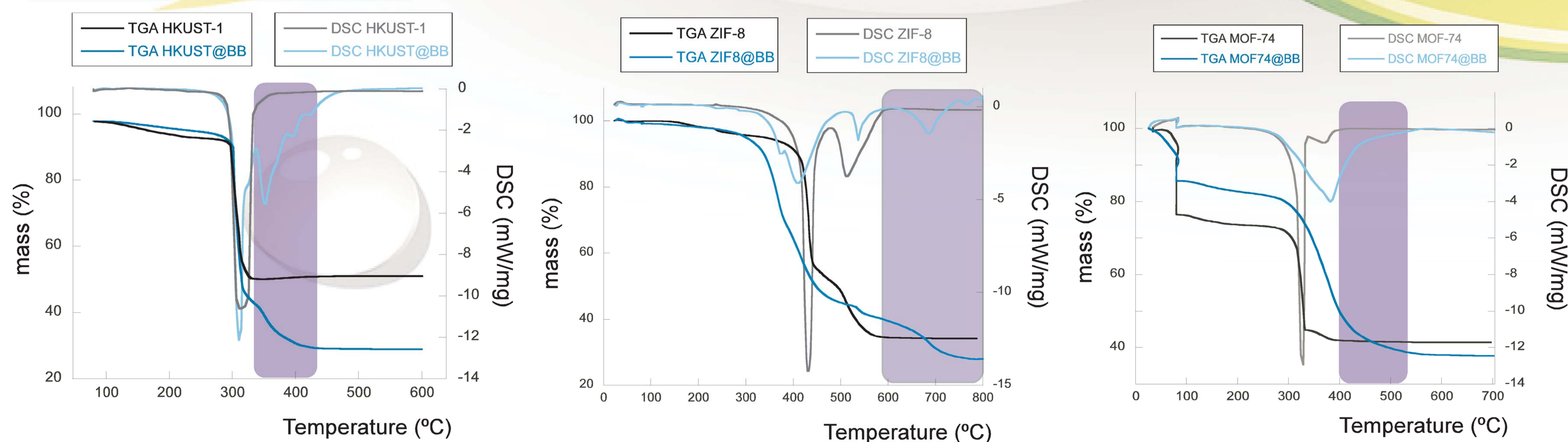
## Chemical Stability

A suspension of each material is made in water or toluene and was stirred for 24 hours at different temperatures.



HKUST-1 is not stable in water, and neither is the composite material. However, the materials resulting after the treatment with water are different. ZIF-8 is stable in water, but the ZIF8@BB composite is not. MOF-74 and MOF74@BB are both stable in water. MOFs are stable in toluene, and so they are the corresponding MOF@IL composites.

## Thermal Stability



HKUST-1 and the composite HKUST@BB both are stable until 300 °C. In the case of ZIF-8, the introduction of the IL reduces the stability temperature from 380 to 300 °C. Finally, MOF-74 is slightly more stable when introducing the IL [BMIM][BF<sub>4</sub>], increasing the decomposition temperature from 290 to 310 °C.

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