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Power Ultrasound and Microwaves in metal-assisted synthesis

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WORKSHOP ON ASYMMETRIC SYNTHESIS
AND NON-CONVENTIONAL
ADVANCED SYNTHETIC TECHNIQUES
FOR FINE CHEMICALS AND PHARMACEUTICALS

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Abstracts' Book

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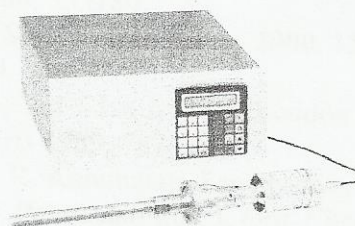
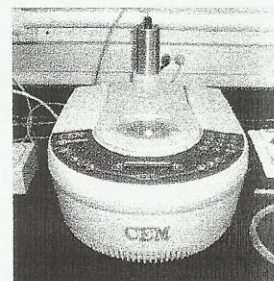
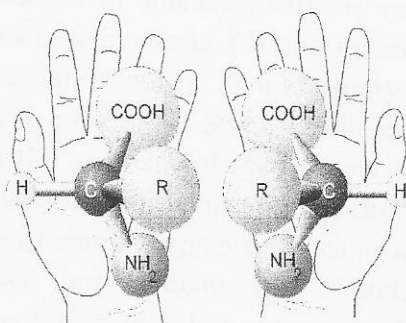
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Power ultrasound and microwaves in metal-assisted synthesis

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The search for greener and more efficient regio- and stereoselective synthetic procedures to provide highly functionalized chemical structures has found, in metal-assisted reactions, a noteworthy contribution. All these reactions fall in the main domain of sonochemistry [1], no other technique can activate the metal and accelerate the process as much as power ultrasound. Although a piece of metal placed inside a microwave oven will lead to dangerous arcing, it is possible to perform organic reactions using well-dispersed fine metal particles in a polar high boiling solvent [2]. After the pioneering studies of Renaud in 1950 on metal-assisted sonochemical reactions [3], the biggest contribution came in the 80's from the group of J.L. Luche, who studied a variety of sonochemical organometallic reactions involving Ni, Li, Zn and Cu. In that decade, studies on the applications of sonochemistry in metal-assisted synthesis showed spectacular development as documented by books [4] and reviews [5]. Since the late nineties we have resorted to Barbier-like reactions (with Li, Zn and mainly In) in the synthesis of natural products, often under sonochemical conditions. Some of these are the synthesis of naturally occurring coumarins [6, 7], indole [8] and oxindole derivatives [9] and indolylbutenes [10]. The copper-catalyzed azide-alkyne cycloaddition (CuAAC) has become the paradigm for click chemistry. Sonication permits the use of simple copper turnings as an efficient and green catalyst in click reactions [11]. Further improvement was found with simultaneous ultrasound/microwave irradiation that strongly promoted heterogeneous catalyzed CuAAC [12, 13] allowing easy access to hybrid adducts that combined the properties of ionic liquids and cyclodextrins [14].

References

- [1] G. Cravotto, P. Cintas *Chem. Soc. Rev.* **2006**, 35, 180.
- [2] A.G. Whittaker, D.M.P. Mingos *J. Chem. Soc., Dalton Trans.* **2000**, 1521.
- [3] P. Renaud, *Bull. Soc. Chim. Fr.* **1950** 1044.
- [4] T. Mason, ed. *Advances in Sonochemistry*, Vol 1 J.A.I. Press, London (1989).
- [5] C. Einhorn, J. Einhorn, J.-L. Luche *Synthesis* **1989**, 787-813.
- [6] G. Appendino, G. Cravotto, G. Palmisano, R. Annunziata *Tetrahedron* **1998**, 54, 10819.
- [7] G. Appendino, G. Cravotto, A. Minassi, G. Palmisano *Eur. J. Org. Chem.* **2001**, 3711.
- [8] G. Cravotto, G.B. Giovenzana, A. Maspero, A. Penoni *Tetrahedron Lett.* **2006**, 47, 6439.
- [9] G. Cravotto, G.B. Giovenzana, G. Palmisano et al. *Tetrahedron Asymm.* **2006**, 17, 3070.
- [10] F. Colombo, G. Cravotto, G. Palmisano, A. et al. *Eur. J. Org. Chem.* **2008**, 2801.
- [11] G. Cravotto, V.V. Fokin, D. Garella, A. Binello, A. Barge, *J. Comb. Chem.* **2010**, 12, 13.
- [12] P. Cintas, K. Martina, B. Robaldo, A. Cravotto *Coll. Czech. Chem. Comm.* **2008**, 72, 1014.
- [13] P. Cintas, A. Barge, T. Tagliapietra, L. Boffa, G. Cravotto, *Nature Protocol* **2010**, 5, 607.
- [14] L. Boffa, E. Calcio Gaudino, Jicsinszky, G. Cravotto, *New J. Chem.* **2010**, 34, 2013.