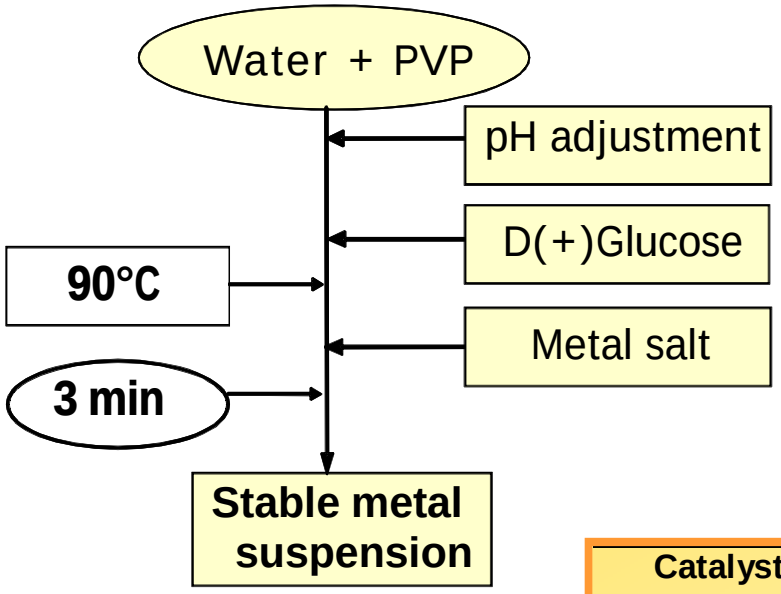
Synthesis of 2,5 furandicarboxylic acid by selective oxidation of 5-hydroxymethyl-2-furfural over Au-Cu/TiO_2 catalysts.

T. Pasini[1], F. Cavani[1], R. Bonelli[1], M. Piccinini[2], N. Dimitratos[2], J. A. Lopez-Sanchez[2], C. Kiely[3], G. Hutchings[2], S. Albonetti[1,*].

[1]Dipartimento di Chimica Industriale e dei Materiali, V.le Risorgimento 4, 40136 Bologna, Italy - INSTM, Research Unit of Bologna, Italy.
[2]Cardiff Catalysis Institute, Main Building, Park Place, Cardiff, CF10 3AT, UK.
[3]Lehigh University, 5 East Packer Avenue, Bethlehem, Pennsylvania, 18015-3195, USA

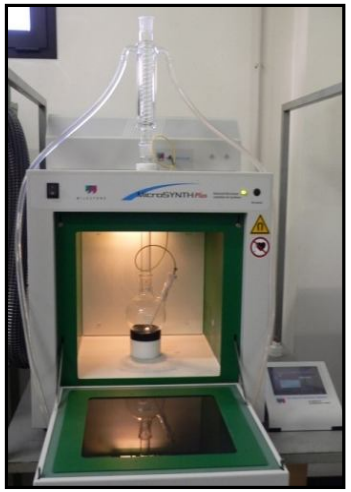
*Corresponding author Tel: 0039-051-2093681, Fax: 0039-051-2093680, e-mail: ***stefania.albonetti@unibo.it***

Catalysts synthesis



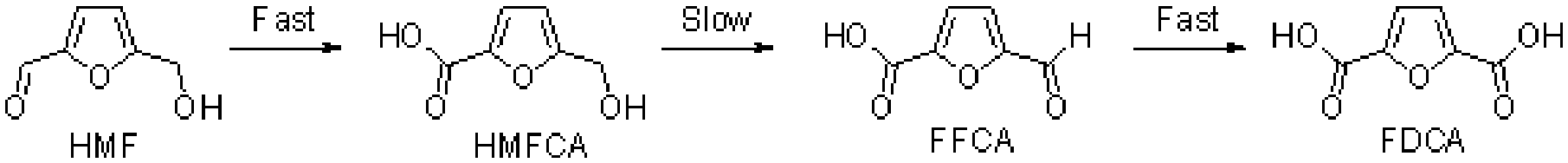
TiO_2

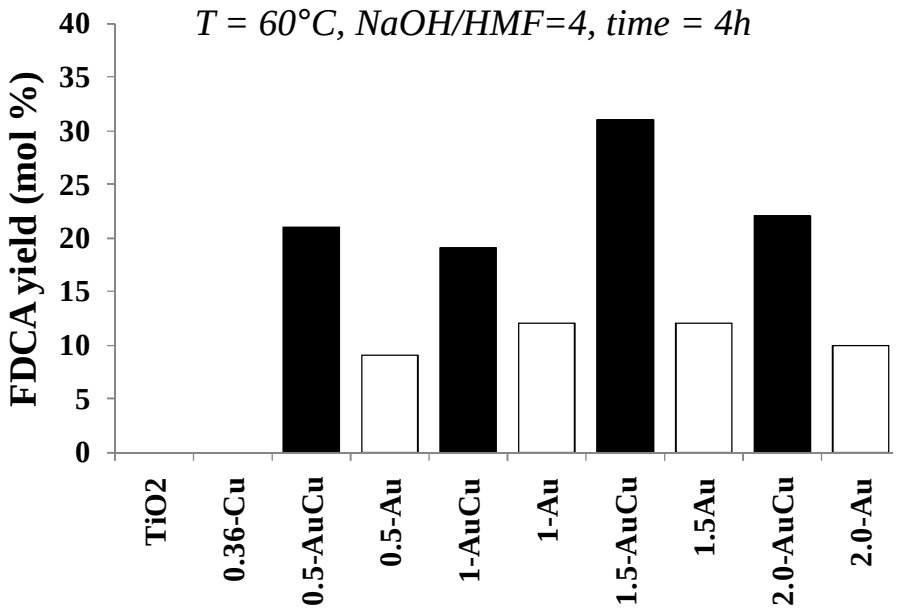
Lab microwave

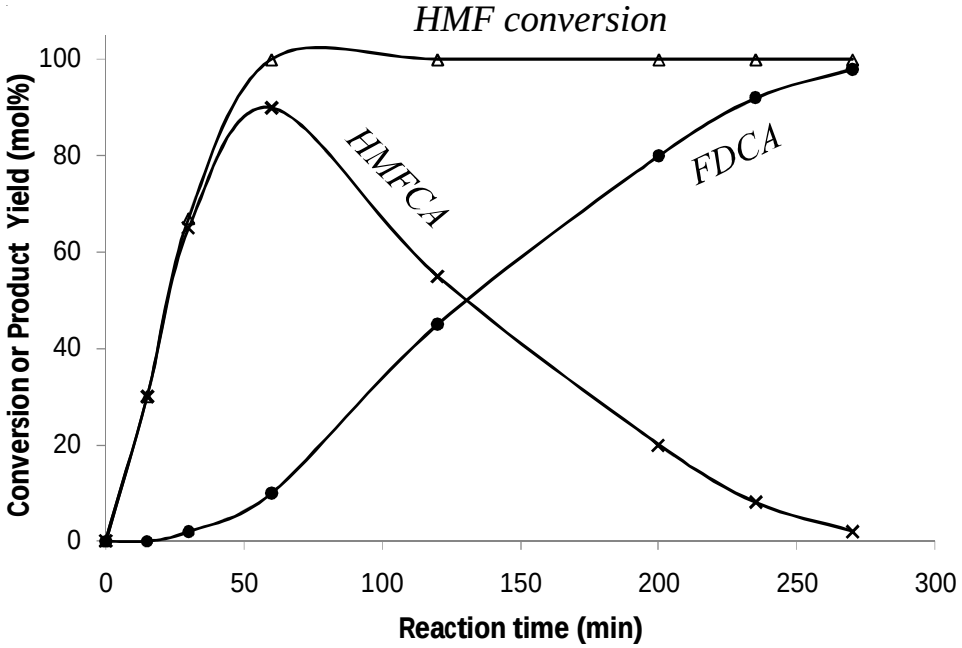


Catalyst	Total Metal Load (% w/w)	Au (% w/w)	Cu (% w/w)	Molar ratio Au/Cu
0.5Au-Ti	0.5	0.5	-	-
1.0Au-Ti	1.0	1.0	-	-
1.5Au-Ti	1.5	1.5	-	-
2.0Au-Ti	2.0	2.0	-	-
0.5(AuCu)-Ti	0.5	0.38	0.12	1
1.0(AuCu)-Ti	1.0	0.76	0.24	1
1.5(AuCu)-Ti	1.5	1.14	0.36	1
2.0(AuCu)-Ti	2.0	1.52	0.48	1

Catalytic reaction





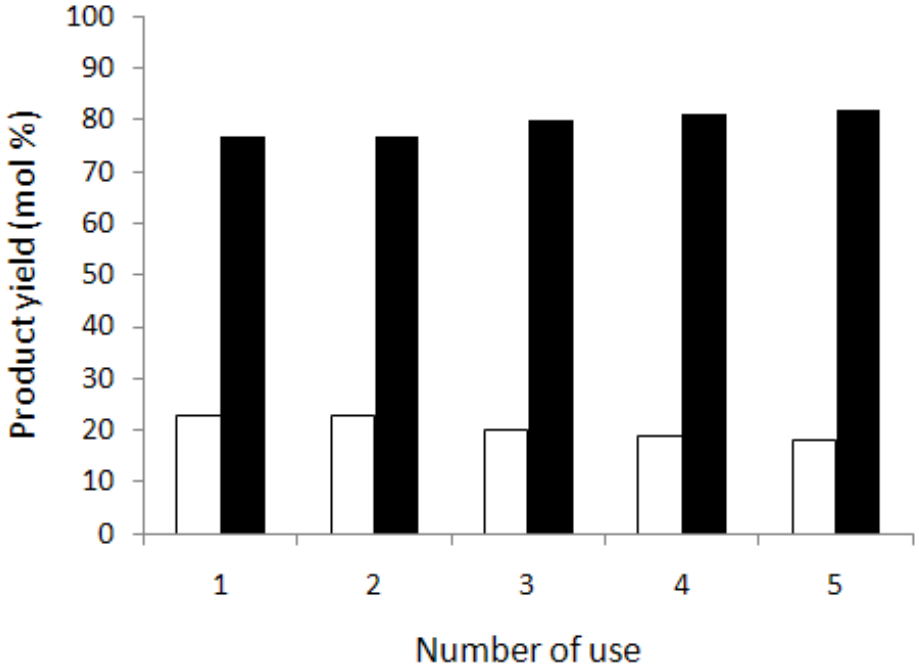


Bimetallic catalysts Monometallic catalysts

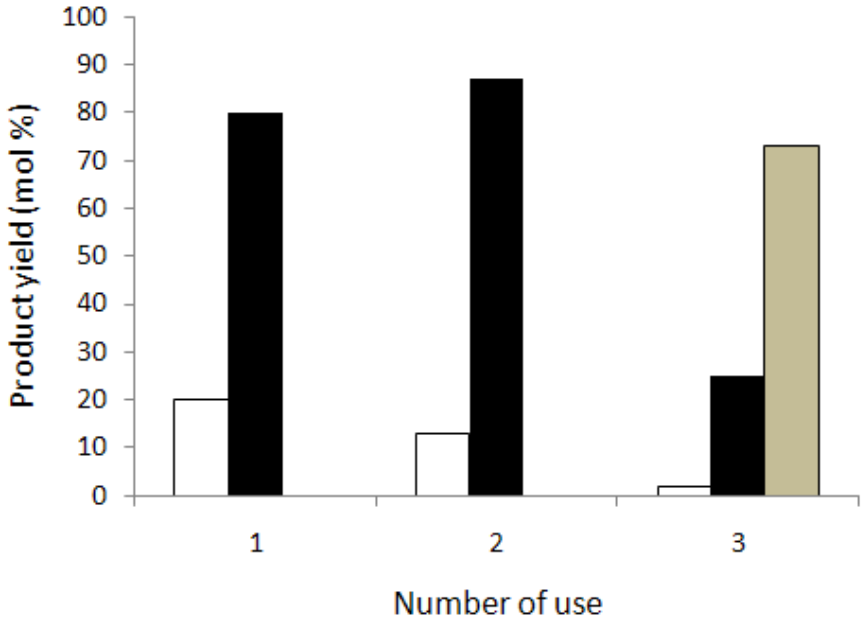
T = 95°C, NaOH/HMF=4

Reusability tests

Reusability test Au-Cu/TiO_2

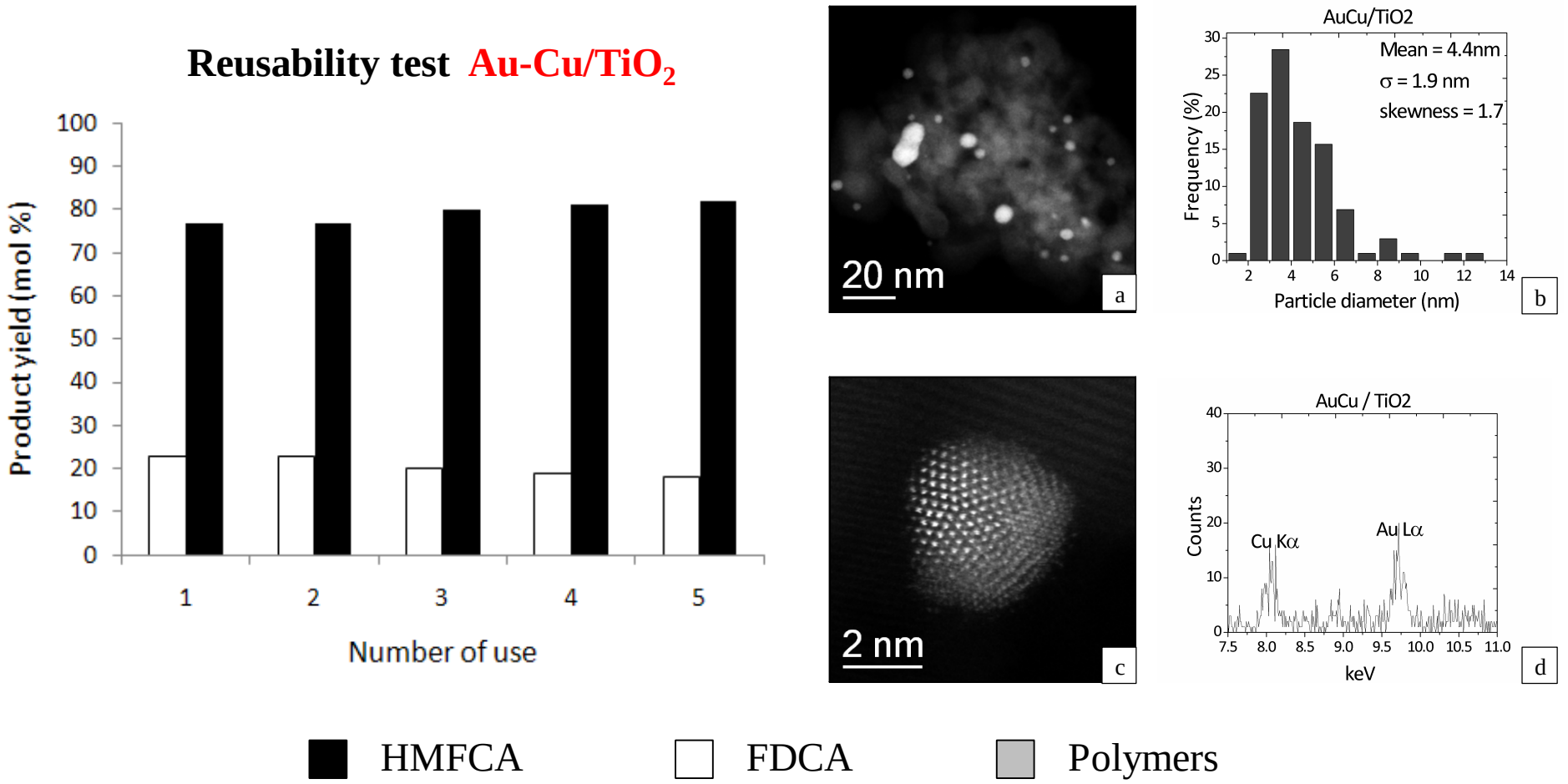


Reusability test Au/TiO_2



HMFCA FDCA Polymers

Reusability tests



Conclusions

- The synthesis of Au-Cu supported nanoparticles, via a colloidal route involving the use of microwave has been shown to produce excellent catalysts for the aerobic oxidation of 5-hydroxymethyl-2-furfural to 2,5-furandicarboxylic acid under mild reaction conditions.

- A strong synergistic effect is evident with the addition of Cu to Au, especially in term of sample stability and resistance to poisoning.

- Reusability tests show that the Au-Cu/TiO_2 catalysts are significantly more stable than their monometallic samples.