IL-4: Ultrasound Assisted Catalytic Reactions and Preparation of Catalysts for Energy Applications

Christos Argirusis\textsuperscript{1,2}

\textsuperscript{1} School of Chemical Engineering, National Technical University of Athens, 15780 Athens, Greece
\textsuperscript{2} Energy Research Center of Lower Saxony (EFZN), 38640 Goslar, Germany
* amca@chemeng.ntua.gr

An overview of ultrasound assisted catalytic reactions as well as the preparation or modification of catalytic active materials by means of ultrasound, sonochemical and sono-electrochemical methods will be given in this lecture.

The coupling of catalytic processes and ultrasound has found a larger number of applications during the past years. Especially in the field of materials science and energy technology its potential for the production of nanomaterials, improved metals, alloys and composites is noteworthy. The advantages of ultrasound procedures, e.g. good yields, short reaction times and mild reaction conditions are well documented \cite{1}.

The combination of ultrasound, electrochemistry and catalysis offers a huge number of possibilities to prepare noble metals and fuel cell electrocatalysts, carbon supported electrocatalysts, fuel cell electrodes and membranes \cite{2}. This concerns the electrochemical synthesis of nanoparticles for catalysis in low temperature fuel cells or for modification of cermet in high temperature ceramic fuel cells, the direct electrodeposition of metal-ceramic composites (even though for high temperature fuel cells these are currently prepared in different ways), and the electrochemical preparation of new battery materials. The combination with ultrasound expands the options considerably. Surface functionalisation of both the support on its own or by decoration with additional metals and/or alloys leads to accelerated reactions and higher yields.

Emphasis will be given to those catalytic materials and their preparation methods, which are used for energy applications. Particularly the operation of solid oxide fuel cells under steam reforming conditions, which depends on the catalytic abilities of their anode materials will be presented along with possibilities how to modify them using ultrasound, in order to obtain C and S tolerant anodic materials. For example such materials are obtained by addition of certain metal nanoparticles (Me-NP) such as Au, Ag, Cu and Mo, W, Re, for S and C tolerance respectively \cite{3}.

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References

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