Introduction to Mössbauer spectroscopy and some selected applications of the method for catalysts' studies

(proposed preliminary program for a condensed course to be held at Dalian Institute of Chemical Physics by prof. Károly Lázár – Centre for Energy Research, Budapest, Hungary)

Tentative schedule

	9:00 - 11:00	14:00 - 16:00	18:00 – 20:00
05/11/2019	1.1 - 1.2	1.3 - 1.4	
06/11/2019	1.5 -1.6	2.1 - 2.3.1	
07/11/2019		2.3.2 - 2.3.4	3.1 – 3.3

Part 1 -Introduction

1.1. Basics of Mössbauer effect

1.1.1. The discovery of the Mössbauer Effect (ME)
1.1.2. Principles of the nuclear gamma resonance absorption
1.1.3. Further nuclear data for ^{57}Fe
1.1.4. Mössbauer active nuclei

1.2. Basics of Mössbauer spectroscopy (MS)

1.2.1. Spectroscopy
1.2.2. Basic parameters (Isomer shift, quadrupole splitting. MHF)
1.2.3. Intensity - Debye-Waller factor – temperature dependence of the effect

1.3. ***Experimental techniques***

1.3.1. Basic units of the electronics – general scheme of a spectrometer
1.3.2.Transmission-, back scattering-, emission-, conversion electron techniques, in-beam excitation of sources. Synchrotron-based nuclear forward scattering. Studies in frozen solutions.

1.4. Evaluation of spectra (description with Lorentz lines – distribution of parameters - other codes)

1.5. Implementation of various techniques, performance of experiments

1.5.1. Limits of accuracy - evaluation of spectra with considering the technical constraints.
1.5.2. Practical illustration: an intercomparison

1.6. History – short retrospection – MEDC

Part 2. - Mössbauer spectroscopy of catalysts

2.1. Assessment of MS from the aspect of catalysts' studies (with respect to catalytic processes)

2.2. Practical accomplishment – in situ cells

2.3. Selected examples for catalysts studies.

2.3.1. *Metals and alloys* *(Fisher-Tropsch, ^{57}Co emission HDS, several Pt-Sn, Au-Sn, Rh-Sn) ^{197}Au Mössbauer spectroscopy*

2.3.2. *Oxides* *(spinels, zeolites, mesoporous catalysts, MOF-s)*

2.3.3. Fe-C-N *(Prussian blue, single atom catalysts)*

2.3.4. molecular catalyst complexes, transient states,

3. Summary

3.1. Closing advices for practisizing experiments,

3.2. Overall conclusions

3.3. Closing remarks
(discussion of any further optional issues)

(Károly Lázár)

22-10-2019.