# Program semináře PCS, Zámecký hotel Lednice listopad 2024

**Pondělí 25. 11. 2024**

13:00-18:00 Instalace přístrojů, předvádění a diskuse nad nimi

**Úterý 26. 11. 2024**

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| 9:00 | Úvod, organizace | J. Malec |
| 9:05 | PCS – historie a současnost | J. Malec |
| 9:10 | PMI a spektrometry Hitachi | P. Zdražil, F. Červinka |
| 9:50 | Integrita povrchu, Barkhausenovský šum Principy a historie | J. Malec |
| 10:25 | Přestávka na kávu | |
| 10:40 | BNA a XRD aplikace v ČR a SR | J. Malec |
| 11:30 | BNA jako nástroj pro monitorování deformačního martenzitu v austenitických ocelích | M. Neslušan |
| 12:00 | Přestávka na oběd | |
| 12:45 | Najnovšie trendy vo vývoji hydridových zliatin kovov pre efektívne uskladnenie vodíka | K. Saksl |
| 14:05 | Automatizace Stresstech a integrita povrchu Měření zbytkových napětí a analýza Barkhausenova šumu | R. Dobrenko |
| 15:15 | Přestávka na kávu | |
| 15:25 | Únava materiálu v souvislostech | J. Pokluda |
| 16:35 | Koncept SERS a ERSI pro hodnocení integrity povrchu | F. Červinka |
| 17:30 | Předvádění přístrojů, detailní diskuse nad jednotlivými zařízeními | |
| 18:10 | Přestávka na večeři | |
| 19:00 | Společenský večer | |

**Středa 27. 11. 2024**

9:00 Předvádění přístrojů, detailní diskuse nad jednotlivými zařízeními

12:00 Ukončení semináře

## Detaily pozvaných přednášek, Zámecký hotel Lednice listopad 2024

### K.Saksl : Najnovšie trendy vo vývoji hydridových zliatin kovov pre efektívne uskladnenie vodíka.

Abstract

In this presentation, we focused on the experimental validation of the semi-empirical concept of Griessen and Driessen, which determines the affinity of solid solutions to hydrogen, with its direct impact on the ability to absorb hydrogen in interstitial sites of single-phase high-entropy alloys. This work highlights the significance of this model in tailoring alloys for specific applications, such as maximizing hydrogen storage or minimizing hydrogen absorption in materials susceptible to hydrogen embrittlement. In the second half of the talk, the application of Barkhausen noise sensing for monitoring material changes due to hydrogen absorption will be discussed.

Biodegradable Alloys:
Recent advancements in materials science have also led to the development of biodegradable alloys. While primarily researched for biomedical and environmental applications, these alloys offer unique advantages in terms of their sustainable lifecycle and reduced ecological footprint. When integrated into hydrogen-related technologies, biodegradable alloys can present an environmentally friendly alternative for temporary or disposable components within hydrogen storage and transport systems. Their interactions with hydrogen, although less studied than traditional high-entropy or metallic alloys, can be of interest for specific scenarios where material degradation over time is acceptable or even desirable, such as in certain single-use or sacrificial components in hydrogen infrastructure. This addition broadens the scope of material choices and encourages a lifecycle approach that considers not only performance but also end-of-life impacts.

Barkhausen Noise Sensing as Non-Destructive Testing (NDT):
Barkhausen noise sensing is a non-destructive testing technique used to evaluate microstructural changes in ferromagnetic materials. It is particularly useful for monitoring the effects of hydrogen absorption, which can significantly alter a material's mechanical properties and structural integrity. The presentation will cover the following applications:

* Pipeline Monitoring: Hydrogen is commonly present in pipelines transporting natural gas or hydrogen gas. Barkhausen noise sensing can detect hydrogen-induced microstructural changes to prevent failures.
* Hydrogen Storage Systems: As hydrogen becomes a more prominent energy carrier, monitoring storage tanks and pressure vessels for hydrogen-related degradation is critical.
* Automotive and Aerospace Materials: Advanced steels and alloys used in these industries are often exposed to hydrogen environments, where Barkhausen noise can help ensure material reliability.

By incorporating biodegradable alloys into the discussion, the presentation acknowledges a broader spectrum of material options, highlighting not only the performance in hydrogen

environments but also the potential for sustainable design in the future development of hydrogen technologies.

## J. Pokluda: Únava materiálu v souvislostech

Outline

I. Empirical Fatigue Characteristics
- Loading cycle
- Wöhlercurve
- Manson-Coffin curve
- Mean stress and fatigue limit

II. Elements of Dislocation Theory
- Dislocation characteristics
- Dislocation movement
- Frank-Read source
- Pile-ups

III. Stages of Fatigue Process
- Nucleation of cracks
- Growth of short cracks
- Growth of long cracks
- Microstuctural distance and fatigue limit

IV. Surface properties and fatigue life
- Hardness
- Roughness
- Residual stress
- Surface treatment

## M. Neslušan: BNA jako nástroj pro monitorování deformačního martenzitu v austenitických ocelích

Abstract

In this presentation, we focused on the different regimes in which austenitic steels undergo the plastic deformation and strain induced martensite is developed as function of many variables such as duration of the load, number of cycles or long term usage in the real load. The phase transition is monitored via magnetic Barkhausen noise and such features as the effective value of Barkhausen noise signal, number of pulses, Barkhausen noise envelopes and the corresponding Peak Position are extracted from the raw signals. The presentation indicates the valuable role of the mutual communication among the martensite islands in the parental austenitic matrix and provide the associated information about this topic on the model materials based on the Fe powders pressed under the variable pressures.

The high sensitivity of Barkhausen noise emission is based on the contrast between the paramagnetic austenite producing no Barkhausen noise and the ferromagnetic strain induced martensite. For this reason, the whole Barkhausen noise signal can be directly related to the process parameters and microstructure features as compared with the conventional ferromagnetic materials having ferritic or/and martensitic structure.

Finally, the role of the background white noise is also discussed when the low background noise to Barkhausen noise ratio can be found. This presentation provides information about subtraction of pure Barkhausen noise emission originating from ferromagnetic body only. Such application as rolling process, shot peening, uniaxial tensile test as well as phase transition on the propeller are demonstrated during the presentation.