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| **Type and description** | **VP** – Visiting Professor  |
| **Course name** | **New Generation Photovoltaics: theory, materials and construction** |
| **Course name in Polish** | Fotowoltaika nowej generacji: teoria, materiały i konstrukcja |
| **Language of instruction** | English |
| **Course coordinator and academic teachers** | **prof. Jiří Pfleger**, Institute of Macriomolecular Chemistry, Czech Academy of Sciences, Prague, Czech Republic; OR[CID](https://poczta.p.lodz.pl/CID): 0000-0001-9576-7551 |
| **Form of classes and number of teaching hours** |

|  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Contact hours | 20 |  | 0 |  | 5 | 5 | 30 |
| E-learning | No | No | No | No | No | Yes |  |
| Assessment criteria (weightage) | 0.70 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 |  |

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| **Course organisation and content** | The course provides a theoretical, material, experimental and technological background of the photovoltaic solar energy conversion and its application. Besides traditional silicon cells it follows modern trends in exploiting new materials, including polymers, and new physical principles. The students will learn mathematical and theoretical background of the photovoltaic effect in various functional structures and materials. Phenomena important for the photoelectrical conversion like photoexcitation in organic and inorganic semiconductors, exciton and polaron formation, free charge generation, charge transport, bulk and surface recombination will be explained. Advanced technologies for power conversion efficiency enhancement will be introduced like concentrator solar cells, two-photon absorption, exciton fusion and fission, plasmonic enhancement, multiple junction cells, tandem cells. Part of the lecture will be dedicated to the approaching thin film technologies like amorphous Si, microcrystalline Si, CdTe, CIS, CIGS, hybrid organic-inorganic solar cells (Grätzel cells) and polymer bulk-heterojunction photovoltaic cells. One chapter of the course will be dedicated to the practical and economical aspects of the application of solar cells in the distribution power networks. The life cycle assessment will provide students with better understanding of the relation between the photovoltaic cells application and environmental protection.  |
| **Assessment methods** | Oral examination (weight 0.7), presentation of seminar work (weight 0.3) |
| **Basic reference materials** | 1. Physics of solar cells : from basic principles to advanced concepts. Peter Würfel, Uli Würfel. -- 2nd updated and expanded ed. Weinheim: Wiley-VCH, 2009.2. Flexible solar cells. Mario Pagliaro, Giovanni Palmisano, and Rosaria Ciriminna. Weinheim : Wiley-VCH, 2008. |
| **Other reference materials** | 1. Solar cell device physics. Fonash, S.J.. 2nd ed., Burlington: Academic Press, 2010. 2. Hou, W.J.; Xiao, Y.M.; Han, G.Y.; Lin, J.Y.: The Applications of Polymers in Solar Cells: A Review. Polymers 2019 (1), 11.3. Chen, F.C.: Emerging Organic and Organic/Inorganic Hybrid Photovoltaic Devices for Specialty Applications: Low-Level-Lighting Energy Conversion and Biomedical Treatment,. Adv. Opt. Mater. 2019 (1), 7. 4. Sadasivuni, K.K.; Deshmukh, K.; Ahipa, T.N.; Muzaffar, A.; Ahamed, M.B.; Pasha, S.K.K.; Al- Maadeed, M.A.: Flexible, biodegradable and recyclable solar cells: a review, J. Mater. Sci.-Mater. Electron. 2019, 30 (2), 951-974.5. Gusain, A.; Faria, R.M.; Miranda, P.B.: Polymer Solar Cells-Interfacial Processes Related to Performance Issues, Front. Chem. 2019, 7.6. Alaaeddin, M.H.; Sapuan, S.M.; Zuhri, M.Y.M.; Zainudin, E.S.; Al-Oqla, F.M.: Photovoltaic applications: Status and manufacturing prospects, Renew. Sust. Energ. Rev. 2019, 102, 318-332.7. Rasi, D.D.; Janssen, R.A.J.: Advances in Solution-Processed Multijunction Organic Solar Cells, Adv. Mater. 2019 (10), 31.  |
| **Average student workload outside classroom** | 20 hrs |
| **Comments** | - |
| **Last update** | 2019-04-12 |