KNJIGA SAŽETAKA

FIRST CONFERENCE OF EUROPEAN CLEAN ENERGY TRANSITION

FKITMCMXIX

HDKI
HRVATSKO DRUŠTVO KEMIJSKIH INŽENJERA I TEHNOLOGA

STUDENTSKA SEKCIJA HDKI

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Hrvatsko društvo kemijskih inženjera i tehnologa (HDKI)
Studentska sekcija HDKI-ja
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PRVA KONFERENCIJA EUROPSKE TRANZICIJE NA ČISTU ENERGIJU

KNJIGA SAŽETAKA

Zagreb, 27. veljače 2021.

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Priprema

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UVODNA RIJEČ

Tijekom posljednjih nekoliko desetljeća globalne temperature naglo su porasle – za približno 0,7°C više nego prije 70 godina. Ljudske emisije ugljikovog dioksida i drugih staklenačkih plinova primarni su pokretač globalnih klimatskih promjena. Vodikova energija postala je uistinu popularna tema i odnosi se na upotrebu vodika i / ili spojeva koji sadrže vodik za proizvodnju energije koja će se dopremati u sve praktične svrhe potrebne za visoku energetsku učinkovitost te je od velike ekološke i socijalne koristi.

Konferenciju smo organizirali kako bismo podigli svijest o negativnim učincima emisija i načinu na koji se mogu riješiti. Cilj nam je bio organizirati projekt na engleskom jeziku kako bi bio dostupan svima širom svijeta. Također, vrlo smo ponosni što možemo reći kako se za ovu konferenciju prijavilo 300 ljudi iz Hrvatske, Njemačke, Češke, Japana; Indije, Izraela, Nizozemske, Velike Britanije, Belgije, Slovenije, Italije, Srbije, Njemačke, Norveške i Bosne i Hercegovine.

Zahvaljujem organizacijskom odboru na odlično organiziranom projektu te Vama koji ste bili dio njega!

Danijela Ivandić,

predsjednica Organizacijskog odbora prve konferencije europske tranzicije na čistu energiju.

SPONZORI:

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Ru-Ve

PROGRAM

27. veljače 2021.g.

POZVANA IZLAGANJA

Frequent Misconceptions About Hydrogen's Role in New Energy Order

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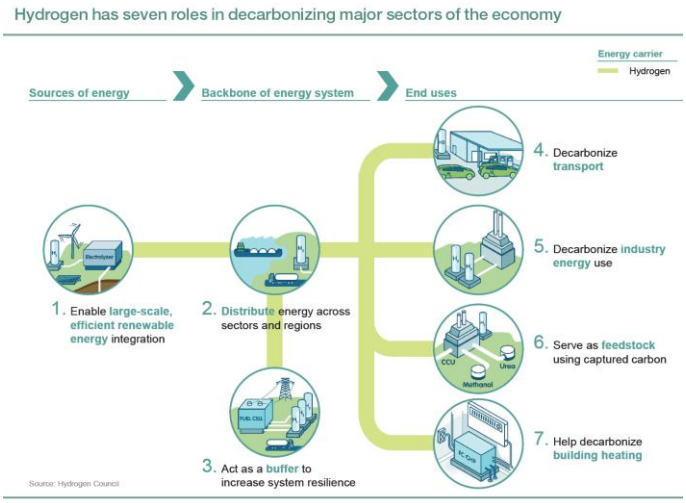
Hydrogen has recently come into a focus of interests as a fuel that can help decarbonize the energy supply [1]. However, at the same time it also draws a lot of critiques, some justifiable and often coming from misunderstanding its role. First of all, hydrogen is not an energy source but rather a synthetic fuel. Production of hydrogen from fossil fuels does not contribute to decarbonization. Therefore, only hydrogen produced from renewable energy sources, so called green hydrogen, has potential to decarbonize certain sectors of energy use. Hydrogen is perceived as a dangerous fuel; indeed it has some physical properties that make it more dangerous than other fuels, but it also has some properties that make it less dangerous. If handled properly hydrogen is at least as dangerous as other fuels. Hydrogen is an inefficient way to store energy, particularly when compared with batteries. That is true, particularly considering that the roundtrip efficiency is 40% at the best, but hydrogen has some properties that make it more suitable for some applications, such as long distance transport or long term/seasonal energy storage. Non-existance of hydrogen infrastructure is often mentioned as a major obstacle for its widespread use. That is also true, but there is no infrastructure for widespread use of battery electric vehicles (current relatively small number of battery electric vehicles can use the existing electro-distribution grid(. A new infrastructure(s) need to be built anyway, and some studies show that hydrogen infrastructure could actually cost less than an infrastructure for battery electric vehicles [2].

In conclusion, green hydrogen is expected to have the following roles in a future energy system [1]: (i) as a fuel for transportation where it offers advantages over batteries or other synthetic fuels (ii) as a fuel and a feedstock for industrial processes, such as steel, cement, ammonia and methanol production, and (iii) as an energy carrier and energy storage medium enabling integration of energy use sectors, and allowing an energy system 100% based on renewable energy sources.



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(accessed 14/02/2021)

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Battery and hydrogen powered electric vehicles: challenges and opportunities

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Clean transportation is very important aspect of the decarbonization of energy sector and one of the pillars of the sustainable development of the society. Electric vehicles and hybrid electric vehicles are an umbrella term for the several different propulsion technologies, most common being the cars driven by the on-board battery systems or by the hydrogen powered fuel cells. Both technologies provide some clear advantages over one another although battery driven cars are nowadays increasingly more popular and start to dominate electric vehicle market. However, no technology provides an ideal solution in terms of specific energy/power content, long range driving distance, short charging time and a long cycle life.

In this talk the state of the art battery technologies from the chemical and electrochemical engineering standpoint will be addressed and their comparison to the fuel cell based hydrogen to electricity generation.

Hydrogen potentials in Croatia from INA's perspective

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Through its policies and new financial instruments, Europe encourages investment in technologies crucial for strengthening competitiveness and the transition to clean energy, especially in the areas of renewable energy technologies, clean hydrogen, carbon capture and storage and sustainable energy infrastructure.

INA has significant potentials for hydrogen production within the Rijeka Refinery but also the possibility of producing green hydrogen at its own locations.

In order to strengthen the competitiveness of Croatian industry and achieve the low-carbon development objectives, INA can encourage the development of the hydrogen economy, especially with the help of co-financing from a wide range of EU funds in the new financial period 2021-2027.

What are EU funds and what is proper purpose of EU funds?

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There is a common misconception that EU funds are pile of money and who ever asks for them is eligible to use them. That, of course is not a truth.

Same as concept project cycling principle of functioning of European Union, EU funds are to be spent to enable achieving certain EU target. Target could be anything from equalling opportunities for all of the regions in EU to reaching ambitious EU's climate targets. It is always the same: EU funds are public money and are to be used for public interest.

In general, EU funds are distributed in accordance to predefined Operational programme, which is in compliance with national and/or EU strategic documents. Operational programme has to have targets and benchmarks for each specific objective. Funds are to be distributed to beneficiaries that could contribute to achieving specific objective's target in most effective way.

System of management and control of EU funds is complicated, but it has to serve it's purpose; using public funds for public interest in a way that ensures equal availability, proportionality of expenditure and benefits and achieving common goals.

Understanding basic principles of EU funds is very important if entrepreneur has an idea or plan for which he or she does not have enough money.

What are Croatia's plan in promoting alternative fuel and energy storage, specially concerning Hydrogen technologies

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European green deal was game changer for decarbonization of all industrial sectors. Decarbonization is not a new thing. Paris Agreement shown will of most relevant world's economy that something regarding reduction of CO2 need to be done very fast. It was a trigger to promotion and boost of renewable energy. In February 2015 Energy Union was presented and one of pillars was decarbonization. Every member state started to produce National Energy and Climate Plan till 2030 where goals and measures for decarbonization were introduced. Croatia submit NECP in December 2019 with goal of 36,4% renewable energy in final consumption.

New energy strategy for Croatia was also adopted in February 2020 and it was two main document that shows how Croatia will decarbonize energy sector.

However, when in December 2019 new President of EC Ms. Ursula von der Leyen presented European green deal and idea that Europe will be first CO2 neutral continent till 2050 it became clear that transition to clean economy will be speed up. Therefore, hydrogen became one of most important issues regarding future EU economy.

Hydrogen can be produced from natural gas (as so called grey hydrogen) but it can also be produced from renewable energy as green hydrogen. It can be used as hydrogen (for example in transport sector, in petrochemical industry etc.) but it can also be transformed in electricity.

In transport sector, hydrogen by fuel cell technology produce electricity and become used as fuel for clean vehicles, especially heavy-duty vehicles where hydrogen show much better performances for preservation of electricity than battery. That is why hydrogen have great potential in energy and transport sector and it is crucial to set up all necessary preconditions for boosting hydrogen economy in EU in next few years. Croatia need to seize the opportunity provided by green hydrogen potential and main intention of this paper is to show all possibilities of production, distribution and usage of hydrogen in Croatia.

The development and application of TiO_2-based nanocomposite photocatalytic materials for solar-driven hydrogen generation

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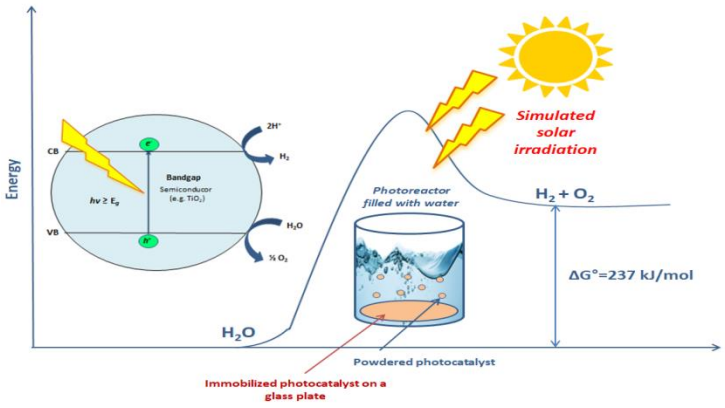
The increase of renewable energy is considered as one of the main goals to achieve a sustainable living environment. Measures to limit greenhouse gases must consider hydrogen production from sustainable energy sources, among which solar-driven photocatalytic processes are found to be quite an interesting alternatives among the scientific community. Most of the photocatalytic studies involve the use of TiO_2 as a benchmark material. Its wide application has been promoted due to: (i) high photocatalytic activity under the incident photon wavelength of $300<\lambda<390$ nm, and (ii) multi-faceted functional properties, such as chemical and thermal stability, resistance to chemical breakdown and attractive mechanical properties (1,2). However, harvesting a broader spectrum of solar irradiation involves lowering the bandgap of semiconducting material, whilst inhibiting the recombination of photogenerated charges. Strategies including doping with non-metals, incorporation or deposition of noble metals (ions), and material engineering solutions based on composites formation between two or more materials, present viable solutions for set tasks (3).

To obtain an effective composite for photocatalytic H_2 applications, it is of great importance to combine TiO_2 with narrow bandgap semiconductors with the visible light response, as well as with electron mediators which enable efficient H_2 production through the synergistic action between two isolated photosystems (4). Therefore, this paper briefly presents novel TiO_2-based nanocomposites that improve existing TiO_2 limitations. Such material, designed to effectively harvest simulated solar irradiation for hydrogen production, can be synthesized by coupling semiconducting composites made of TiO_2, visible-light response chalcogenides (SnS_2 and MoS_2), and carbon-based materials as electron mediators (GO/RGO). An obtained synergistic effect between two or more semiconductors can promote efficient charge separation, sufficient visible light response, and high photocatalytic performance.



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Ionic liquids in Supported Ionic Liquid Phase (SILP) catalysis

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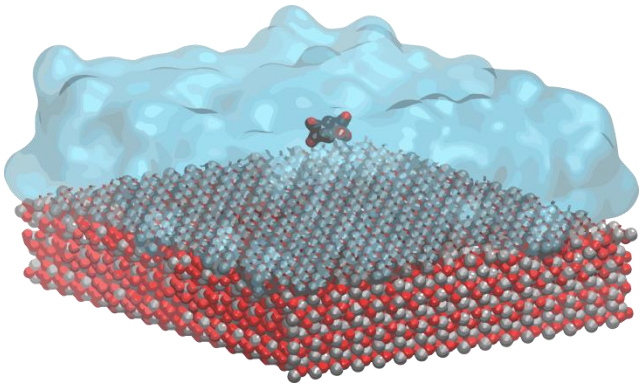
The present importance of ionic liquids (ILs) in the field of materials and chemical engineering is difficult to overemphasize. In the state of the art computational study, we established a model and provided a detailed analysis of static and dynamic properties on a prototypical ionic liquid film, which interfaces with a solid alumina surface and a vacuum. This geometry is designed to represent a typical setup used in the novel, experimentally designed Supported Ionic Liquid Phase (SILP) catalysis.

While there are currently numerous attempts to characterize films of molecular liquids on solid support, using molecular modeling techniques, our study stands out by its technical rigor - our approach is unique in that it is systematically tested against available experiments on liquids in the bulk, solid-liquid, and liquid-vacuum interfaces. In that sense, we believe we have significantly raised the standards of molecular modeling of ILs and established a prototypical protocol for the determination of the correct parametrization of ILs.

Using this model, we are, for the first time, able to relate the conformational molecular features with the structural properties of the liquid throughout the film from the solid to the vacuum interface. Most significantly, these features are further associated with the non-homogenous dynamic properties of the film, which we believe is the first analysis of this type in the literature of ILs.



Innovative model to drive energy security and diversity in the Danube Region via combination of bioenergy with surplus renewable energy (DanuP-2-Gas)

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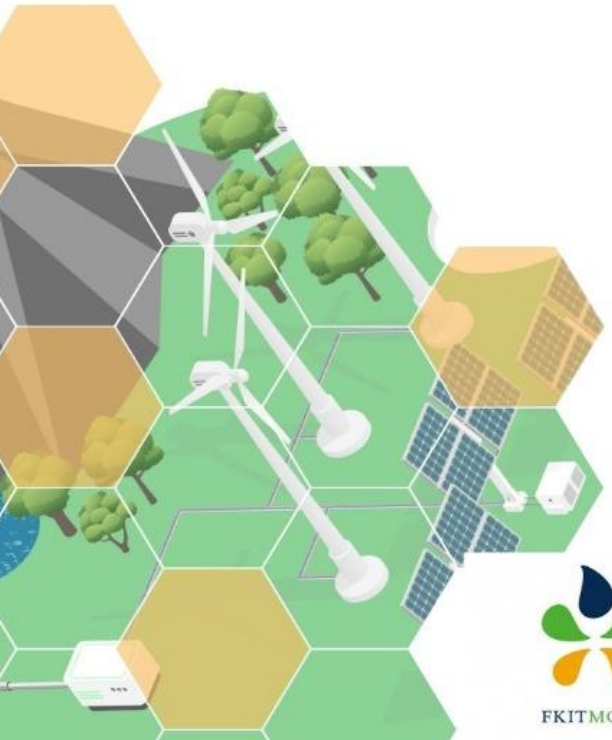
The Danube Region holds huge potential for sustainable generation and storage of renewable energy. However, to date, this region is highly dependent on energy imports, while energy efficiency, diversity and renewables share are low.

In line with the European Union's (EU) climate targets for 2030 and the EU Strategy for the Danube Region (EUSDR) project area 2 goals, project titled "*Innovative model to drive energy security and diversity in the Danube Region via combination of bioenergy with surplus renewable energy*" (acronym: DanuP-2-Gas) will advance transnational energy planning by promoting generation and storage strategies for renewables in the Danube Region, by coupling the electric power and gas sector.

DanuP-2-Gas will bring together energy agencies, business actors, public authorities and research institutions via the Danube Energy Platform. Based on the platform developed during DTP project ENERGY BARGE it will incorporate all pre-existing tools and an Atlas, mapping prior unexamined available biomass and energy infrastructure.

Further, a pre-feasibility study utilizing an optimization tool for efficient hub design will identify suitable locations for sectors coupling hubs and combination of two idle resources in the Danube region. Unused organic residue (e.g. straw) will be processed to biochar for easy transport along the Danube River and as basis for synthesis gas generation. Adding hydrogen produced from surplus renewable energy allows to upgrade this syngas to renewable natural gas. This will enable storage of surplus energy in the existing gas distribution grid increasing energy security and efficiency.

All needed resources are available in the Danube region and the 10 partner countries. Thus, a transnational approach along the main transport route (Danube River) to share these resources is the key. The legal framework influencing the concept will be assessed on individual country level, leading to a transnational strategy with national roadmaps for simple implementation. Finally, impact of DanuP-2-Gas will be ensured via trainings on the developed tools and workshops elaborating future projects and business models with interested stakeholders.



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