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Conference Report

Abstract of the 4th International Online Conference on Crystals †

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† Presented at the 4th International Online Conference on Crystals, 18–20 September 2024; Available online: https://sciforum.net/event/iocc2024.

Abstract: The 4th International Online Conference on Crystals (IOCC 2024), Part of the International Electronic Conference on Crystals series, was held online from 18 to 20 September 2024. This is a new and improved initiative based on the experience from the first, second, and third International Electronic Conference on Crystals. The fourth conference was organized around seven topics and related themes: Liquid Crystals, Crystal Engineering, Inorganic Crystalline Materials, Organic Crystalline Materials, Hybrid and Composite Crystalline Materials, Materials for Energy Applications, and Crystalline Metals and Alloys. The scope of this online conference is to bring together well-known worldwide experts who are currently working on Crystals to provide an online forum for presenting and discussing new results. The present report will start by providing an overview of the keynote speeches and the main axes around which the communication sessions revolve before moving on to more detailed abstracts, presenting each of the topics presented during the IOCC 2024 conference.

Keywords: liquid crystalline; crystallographic; materials; energy applications

1. Conference Introduction

The 4th International Online Conference on Crystals (IOCC 2024), chaired by Prof. Dr. Alessandra Toncelli, was held online from 18 to 20 September 2024. It was organized by MDPI and MDPI journal *Chemistry Proceedings*, containing the following topics:

- S1. Liquid Crystals
- S2. Crystal Engineering
- S3. Inorganic Crystalline Materials
- S4. Organic Crystalline Materials
- S5. Hybrid and Composite Crystalline Materials
- S6. Materials for Energy Applications
- S7. Crystalline Metals and Alloys

There were seven speakers invited to give speeches in the conference. Please find the details at https://sciforum.net/event/iocc2024?subscribe&section=#event_speakers.

2. Liquid Crystals

2.1. The Universe in a Liquid Crystalline Droplet

Samo Kralj [1], Damjan Dovnik [2], Maha Zid [3], Milan Svetec [4], Sasa Harkai [2], Iztok Babič [2] and Charles Rosenblatt [5]

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non-zero, and it grows sharply with increasing frequency. The appearance of non-zero longitudinal attenuation is accompanied by a deviation of the frequency propagation coefficient dependence from the linear law. With a further increasing frequency, the propagation and attenuation parameters grow, reach a maximum, and then reduce. It follows from the above that when a non-monochromatic wave arrives at the conductive layer, a redistribution of harmonics across amplitudes occurs during surface wave propagation. This effect can be used to create plasmonic waveguides that filter frequencies, corresponding to the minimum longitudinal attenuation coefficient (plasmonic filters). We established that with rising semiconductor layer thickness and dielectric constant of insulating layers, the propagation and attenuation parameter maxima shift towards lower frequencies. Thus, by varying the thickness and selecting the material of the insulating layers with the desired optical characteristics, it is possible to change plasmonic filter pass frequency.

7.7. Nano-Enhanced Phase Change Materials Doped with Carbon Allotropes for Thermal Energy Storage: A Patent Landscape Analysis

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Nano-enhanced phase change materials (NePCMs) are composites made of an organic or inorganic PCM and nanoparticles (metal, metal oxide, carbon nanotube, graphite, graphene) capable of increasing their thermal capacity or conductivity.

PCMs are classified into three categories, namely organic, inorganic, and eutectic.

This study focuses on the patent analysis of organic NePCMs doped with carbon allotropes for thermal energy storage.

Patent searches were carried out using two databases (Espacenet, provided free of charge by the European Patent Office, and Orbit, a paid-for system provided by Questel) using precise and controlled keywords in the title/abstract/claims search fields with Boolean and proximity operators and classification codes.

Classification symbols were retrieved by means of the Espacenet classification search tool and the WIPO IPCCAT system.

China is the country with the highest number of patent applications filed for NePCMs with carbon allotropes, followed by the United States, Europe, and South Korea.

The number of patent applications filed increased from 2016 to 2022.

However, it should be noted that the figures for later years are not reliable, as applications are kept secret for the first 18 months after filing.

Graphene and its derivatives are the most frequently claimed compounds in applications and granted patents, followed by carbon nanotubes.

Fullerenes are rarely claimed (1.4% compared to graphene and derivatives), with an even smaller percentage claimed for other nanosized carbon materials (such as nano-onions, nanoscrolls, nanohorns, nanocones, nanowalls, and nanocoils).

Approximately 30% of the applications have either expired or been revoked or withdrawn.

Of the active patents, between 35% (for nanotubes) and 40% (for graphene) remain under examination.

The most commonly used PCMs in combination with carbon allotropes are paraffin, stearic and lauryl acids, and lauryl alcohol.

7.8. Lithium Adsorption Properties of Two-Dimensional Chromium Nitride

Amretashis Sengupta

Department of Physics, P.D. Women's College (affiliated to University of North Bengal)

Two-dimensional (2D) materials promise improved performance and energy storage capacities in next-generation Li-ion batteries due to their large surface area, enhanced