

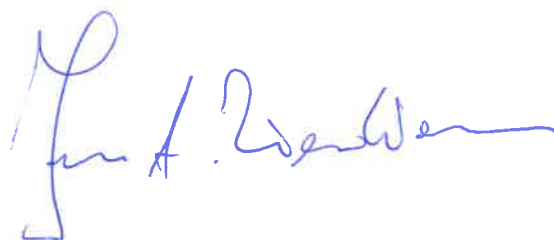
Abstract of the doctoral dissertation of Jan Albert Zienkiewicz, M.Sc., entitled "*Influence of alkyl derivatives of hydrazine on physicochemical properties and mechanisms of phase transformations in selected hybrid organic-inorganic crystals of perovskites and perovskitoids*" performed under the supervision of Dr. hab. Maciej Ptak

This doctoral thesis consists of a thematically consistent series of five scientific publications connected by the subject of the influence of ammonium cations, that are methyl derivatives of hydrazinium, on the physicochemical properties of hybrid materials classified as perovskites and perovskitoids. The texts of the publications have been provided with an introductory commentary on their subject, the most important results have been discussed, and the conclusions drawn from their analysis have been put together.

During the research, seven novel hybrid compounds were synthesized that had not been published before. Therefore, characterizations of their structural, thermal, dielectric, magnetic, phonon, and spectroscopic properties have been performed. Huge attention has been paid to the investigation of optical properties in the UV-Vis range, as well as characteristics of their phonon properties using infrared (IR) and Raman spectroscopy. For the majority of crystals, factor group analysis has been performed. IR and Raman bands have been assigned, and changes in the spectra as a function of temperature and/or pressure have been discussed. Special attention has been devoted to the study of phase transition mechanisms utilizing X-ray diffraction (XRD) and vibrational spectroscopy methods. Moreover, geometry optimization and simulation of IR and Raman spectra using DFT (density functional theory) methods have been carried out for the 1,1-dimethylhydrazine molecule and the 1,1-dimethylhydrazinium cation (DMHy<sup>+</sup>).

The physicochemical properties of obtained compounds have been compared with each other and with similar materials described before, varying in parameters such as size and type of ammonium cation, with particular emphasis on alkyl hydrazinium derivatives, and size and type of other ions creating the structure of the material. Based on that, the influence of the number of methyl groups in hydrazinium derivatives on the physicochemical properties of hybrid materials from the group of transition metal formates and lead and transition metal halides has been analyzed.

Studies on the properties of novel compounds together with a thorough analysis of the influence of steric hindrance of the ammonium cation on the properties of obtained materials contribute to a better understanding of the physical chemistry of perovskite-type materials in the context of further optoelectronic applications.

A handwritten signature in blue ink, appearing to read "Jan A. Zienkiewicz".