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Monte Carlo analysis of KRITZ-2 critical benchmarks on the reactivity temperature coefficient using ENDF/B-VII.1 and JENDL-4.0 nuclear data libraries

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A set of KRITZ-2 experiments light water moderated lattices with uranium oxide and mixed-oxide fuel rods, at room and elevated temperatures, performed in the early 1970's have been assessed. Using the MCNP6.1 code with the most recent cross section libraries: JENDL-4 and ENDF/B-VII.1, the critical experiments KRITZ: 2-1, KRITZ: 2-13, and KRITZ: 2-19 were analyzed. We have used the Makxsf and NJOY utilities to handle the data in the specific temperatures not available in the MCNP6.1.1 original data. The detailed comparisons of the calculated and measured effective multiplication factors and pin power distributions for UO_2 and MOX fuelled cores presented in this work demonstrate a good agreement between calculation and measurements. The maximum deviation of the calculation from the experimental data for keff, is 0.58% (absolute value) obtained for the KRITZ 2:1at 248.5°C using ENDF/B-VII.1 data. To investigate better the influence of cross sections differences on the reactivity and temperature coefficient, we break down the infinite multiplication factor into its components using a pin cell model. We have also calculated the non-leakage probability and the associated temperature coefficient. For the Reactivity Temperature Coefficient, our analysis has shown that the tendency of a negative error (overestimation by calculation of the absolute value of the RTC) usually observed when analyzing similar UO_2 and MOX LWR lattices is confirmed. However, the level of the calculation error has been reduced significantly by using Monte Carlo modeling associated with the most recent nuclear data libraries.

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Microwave-assisted hydrothermal synthesis of nanosized hexagonal plate-like nickel-doped CeO_2: Structure and activity

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Ceria is one of the most important lanthanide oxide and has been attracted by the attention of the researchers due to the wide range of application such as catalyst for hydrogen production from fuel, solid state conductor for fuel cell, oxygen storage promoters etc. The magnetic nature of CeO2 is also an important feature for magnetic data storage device or magnetically recoverable catalyst. The structural features of ceria in combination with oxygen storage and release properties are crucial for various heterogeneous catalytic reactions. The incorporation of Ni into ceria mixed oxides structures may strongly modifies the structural and textural properties, which influence the kinetics of bulk oxygen diffusion. Since physical and chemical properties are highly dependent on their structure, shape and size, controlled fabrication is one of the key issues in nanomaterials. A novel type of Ni-doped hierarchical hexagonal plates like ceria has been prepared by practical microwave hydrothermal method, a full structural, textural and optical characterization is realized and its catalytic activity is evaluated for Bhisphenol A photo-oxidation. XRD characterization shows the well crystalline phase fluorite of ceria. No any peaks from Ni or NixOy are seen, it may be due to incorporation of Ni atoms into the framework of ceria. The fitting of XPS spectra for Ni2p, O1s S2p and Ce3d confirms the incorporation of nickel atoms into the framework of ceria and vacancies generation. According to Eg value of 2.7 eV and the oxygen vacancies, these materials are also adequate for drugs as well as endocrine disrupter compounds degradation under solar or visible irradiation. FESEM image of ceria doped with 3 mole of nickel it is observe the hexagonal plates with average size of 40 nm, and less than 5 nm of thickness. Time is the key parameter for homogenous and nanometric size of well defined hexagonal plate-like.

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