**PARUPM: A SIMULATION CODE FOR PASSIVE AUTOCATALYTIC RECOMBINERS.**

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In the event of a severe accident with core damage in a water-cooled nuclear reactor, combustible gases (H2 and possibly CO) get release into the containment atmosphere. An uncontrolled combustion of a large cloud with a high concentration of combustible gases could lead to a threat to the containment integrity if concentrations within their flammability limits are reached. To mitigate this containment failure risk, many countries have proceeded to install passive auto-catalytic recombiners (PARs) inside containment buildings. These devices represent a passive strategy for controlling combustible gases, since they are capable of converting H2 and CO into H2O and CO2, respectively. In this work, the code PARUPM developed by the Department of Energy Engineering at the UPM is described. This work is part of the AMHYCO project (Euratom 2014-2018, GA No 945057) aiming at improving experimental knowledge and simulation capabilities for the H2/CO combustion risk management in severe accidents (SAs). Thus, enhancing the available knowledge related to PAR operational performance is one key point of the project. The PARUPM code includes a physical-chemical model developed for the study of surface chemistry, and heat and species mass transfer between the H2/CO/air/steam/CO2 mixture and the catalytic plates in a PAR channel. This model is based on a simplified Deutschmann reaction scheme for surface combustion of methane, and the Elenbaas analysis for buoyancy-induced heat transfer between parallel plates. Mass transfer is considered using the heat and mass transfer analogy. PARUPM is capable of simulating the recombination reactions of H2 and CO inside the catalytic section of the PAR. In addition, this model allows studying the effect of CO in the mixture, allowing to explore the effect of this compound on transients related to accidents that advance towards the ex-vessel phase. Finally, a thorough analysis of the code capabilities executed by comparing the numerical results with experimental data obtained from the REKO-3 facility. This analysis allows to establish the ranges in which the code is validated and to further expand the capabilities of the simulation code which will lead to its coupling with thermal-hydraulic codes in future steps of the project.