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Ventilation Air Methane (VAM) Utilisation: Comparison of the Thermal and Catalytic Oxidation Processes

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A significant problem in hard coal mining is the utilisation of ventilation air methane (VAM). Two basic methane combustion methods, thermal (homogeneous) and catalytic oxidation, are analysed in detail in this paper. Both processes are compared based on numerical simulations, applying the reaction kinetics developed in previous works, assuming a few typical monolithic reactor packings. The reactor's mathematical model and kinetic equations are presented. The results are presented graphically as the temperature and reactant concentration distributions along the reactor, assuming different inlet methane concentrations in the VAM, inlet gas temperature and flow velocity. Interstage reactor cooling is simulated with a higher methane concentration for the catalytic process. The energetic problems of the process are analysed in terms of the heat recovery and resulting exergy, as well as the Carnot efficiency. The problem of toxic carbon monoxide emissions is also modelled and discussed, and the pros and cons of both VAM combustion methods are identified.

Metryczka

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