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(54) Title: SELECTIVE HYDROGENATION METHODS AND CATALYSTS

(57) Abstract: The present disclosure relates to methods for selectively hydrogenating acetylene, to methods for starting up a selective hydrogenation reactor, and to hydrogenation catalysts useful in such methods. In one aspect, the disclosure provides a method for selectively hydrogenating acetylene, the method comprising contacting a catalyst composition with a process gas. The catalyst composition comprises a porous support, palladium, and one or more ionic liquids. The process gas includes ethylene, present in the process gas in an amount of at least 20 mol.%; and acetylene, present in the process gas in an amount of at least 1 ppm. At least 90% of the acetylene present in the process gas is hydrogenated, and the selective hydrogenation is conducted without thermal runaway. Notably, the process gas is contacted with the catalyst at a gas hourly space velocity (GHSV) based on total catalyst volume in one bed or multiple beds of at least 7,100 h⁻¹.