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(54) **HYDROGEN STORAGE BY REVERSIBLE HYDROGENATION OF PI-CONJUGATED SUBSTRATES**

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See application file for complete search history.

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(57) **ABSTRACT**

Processes are provided for the storage and release of hydrogen by means of a substantially reversible catalytic hydrogenation of extended pi-conjugated substrates which include large polycyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons with nitrogen heteroatoms, polycyclic aromatic hydrocarbons with oxygen heteroatoms, polycyclic aromatic hydrocarbons with alkyl, alkoxy, nitrile, ketone, ether or polyether substituents, pi-conjugated molecules comprising 5 membered rings, pi-conjugated molecules comprising six and five membered rings with nitrogen or oxygen hetero atoms, and extended pi-conjugated organic polymers. The hydrogen, contained in the at least partially hydrogenated form of the extended pi-conjugated system, can be facilely released for use by a catalytic dehydrogenation of the latter in the presence of a dehydrogenation catalyst which can be effected by lowering the hydrogen gas pressure, generally to pressures greater than 0.1 bar or raising the temperature to less than 250° C. or less, or by a combination of these two process parameters.

23 Claims, 24 Drawing Sheets