The catalytic activity of carbon-supported Pd nanoparticles (NPs) was investigated in the hydrogenation of anthracene at different temperatures and reaction times. These nanocatalysts were prepared by direct reduction of a palladium precursor impregnated on the carbon support. Small spherical and homogeneously dispersed Pd NPs were thus achieved. Nanocatalyst performance was evaluated as a function of surface properties, including porosity, defects and Pd NPs population. High conversions and selectivities towards the hydrogenated products without cracking or ring-opening products were achieved. The selectivity of the nanocatalysts to the production of hydrogenated species depended on temperature, reaching a maximum at 300 ºC. At this temperature and short reaction time, the catalytic activity is thought to have been favored by the presence of a large amount of surface defects in the nanocatalysts that can promote hydrogen transfer to the anthracene molecule. On the other hand, at longer reaction times the porosity and density of Pd nanoparticles on the catalyst were the factors behind the deeper hydrogenation achieved. Finally, a plausible reaction pathway for anthracene hydrogenation in the presence of these Pd nanocatalysts was proposed.