Heterobimetallic Catalysts for the Thermal Decomposition of Ammonium Perchlorate: Efficient Burning Rate Catalysts for Solid Rocket Motors and Missiles

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Abstract
We show the synthesis and characterization of four heterobimetallic compounds derived from s-indacene of general formula [{(CO)3Mn}-s-Ic-{MCp*}]q with M = Fe, Co, Ni, and Ru; q = 0, 1+. The complexes reported here were characterized by 1H and 13C NMR, elemental analysis and FT-IR. Additionally, the X-ray crystal structure of [(CO)3Mn-s-Ic-FeCp*] (1) and Mössbauer spectra are reported. The heterobimetallic compounds exhibit higher quasireversible redox potentials compared with ferrocene and catocene under the same reaction conditions. The complexes were tested as catalysts on the thermal decomposition of ammonium perchlorate examined by a differential scanning calorimetry technique to study their catalytic behavior. Compound (1) causes a decrease of ammonium perchlorate's decomposition temperature to 315 °C, consequently increasing the heat release by 138 J·g-1. Conversely, [{(CO)3Mn}-s-Ic′-{CoCp*}] (2) presents a higher heat release (2462 J·g-1), comparable to catocene.

Engineering controlled terms:
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Organometallics
Redox reactions
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