Supporting Information

New Strategy for High-Performance Integrated Catalysts for Cracking Hydrocarbon Fuels
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SM1. Synthesis of Hydrocarbon-soluble Hyperbranched Poly(amideamine) (CPAMAM)

Preparation of Hyperbranched Poly(amideamine) (HPAMAM) from MA and EDA. Methyl acrylate (MA, 28.41 g, 0.33 mol) was added dropwise into a mixture of ethylenediamine (EDA, 19.84 g, 0.33 mol) and methanol (30 mL) with magnetic stirring. After the reaction was kept at room temperature for 48 hours, the flask was fixed onto a rotary evaporator to remove the methanol under the vacuum at room temperature. The mixture was then kept in an oil bath for 1 h at 60 °C, 2 h at 100 °C, 2 h at 120 °C, and 2 h at 140 °C on a rotary evaporator under vacuum to generate macromolecules. The crude product was redissolved in 50 mL of methanol, followed by precipitation in 300 mL of ethyl ether. After the separation from the ether layer, the final product was obtained as a viscous yellow liquid.

Preparation of CPAMAM by modification of HPAMAM. A typical modification procedure of PAMAM with palmitoyl chloride is as follows: Freshly distilled palmitoyl chloride (1.5 mol equiv per −NH2 group) was dissolved in 12 mL of chloroform and then was added slowly into a solution with 2 g of PAMAM in 24 mL of chloroform and 6 mL of triethylamine. The reaction was performed at 35 °C for 24 h with magnetic stirring. The crude product was redissolved in chloroform and washed with saturated brine 3 times to remove palmitates. The organic layer was dried with magnesium sulfate and treated with rotatory vaporization to obtain a yellow waxy solid product.

SM2. Synthesis of Octadecylamine-coated Pd NP, Pd@18N.

Na2PdCl4 was dissolved in water, and TOAB was dissolved in toluene. The solution was mixed by sonication in a three-necked bottle. The two-phase mixtures were stirred until PdCl22+ was transferred to the toluene phase. During the stirring process, the orange water phase was gradually changed to colorless, while the toluene phase changed to be deep red. The toluene phase was then separated from water phase, and octadecylamine was added in a mole ratio of Pd:C18H37NH2 = 1:12. NaBH4 was dissolved in water as a reducing agent, and was added dropwise into the toluene phase. After the deep red became black in
the toluene phase, the solvent was removed by rotary evaporation, and the black powder of Pd@18N was obtained after it was washed with ethanol for three times.

Figure S1. XRD patterns of Pd@18N, Pd@CPAMAM, Pt@CPAMAM and Au@CPAMAM.
Figure S2. TGA (solid lines) and DTG (dashed lines) curves of (a) Pt@CPAMAM and of (b) Au@CPAMAM.

Figure S3. Relative metal contents of nanofluids with Pt@CPAMAM and Au@CPAMAM during thermal stability tests of the 360-day storage period.

Figure S4. Relative metal contents of nanofluids with Pt@CPAMAM and Au@CPAMAM during thermal stability tests at a high temperature of 180 °C.
Figure S5. Major gaseous products from the cracking of decalin with different samples (a. Pure decalin; b. decalin with CPAMAM; c. decalin with Pd@18N; d. decalin with Pd@CPAMAM; e. decalin with Pt@CPAMAM; f. decalin with Au@CPAMAM).
Figure S6. Alkene selectivity in gaseous products from the cracking of decalin with (a) different Pd NPs, with (b) different HEMNs.

Figure S7. Relative content in liquid products from the cracking of (a) decalin, (b) decalin + Pd@CPAMAM, (c) decalin + Pt@CPAMAM, and (d) decalin + Au@CPAMAM.
Figure S8. Temperature and pressure drop during the cracking of decalin: (a) pure Decalin, (b) Decalin with Pd@CPAMAM, (c) Decalin with Pt@CPAMAM, and (d) Decalin with Au@CPAMAM.