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Synthesis of thiospinel $CuCo_2S_4$ and $CuCo_2S_4$/ reduced-graphene oxide nanohybrids as highly effective catalysts for the Sonogashira reaction

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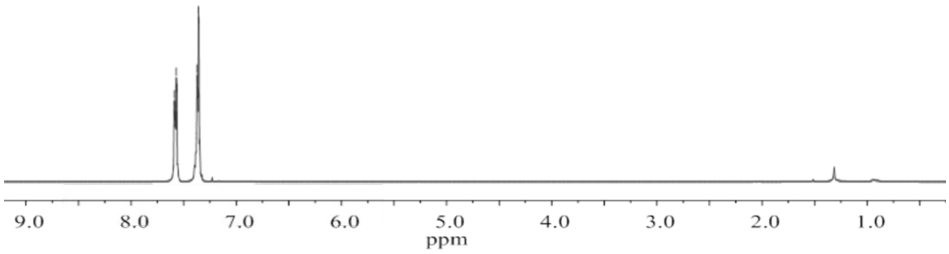
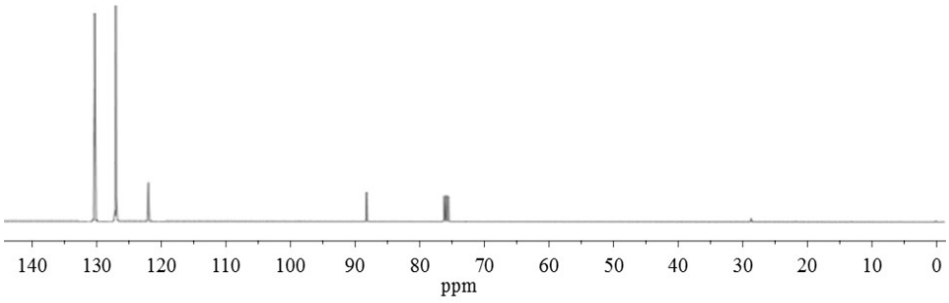
Analytical data for compounds

The following product was identified by comparison with previously reported spectroscopic data:

Diphenylacetylene (1a).[1] ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.53-7.50 (m, 4H), 7.38-7.30 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 88.37, 122.20, 127.27, 130.53.





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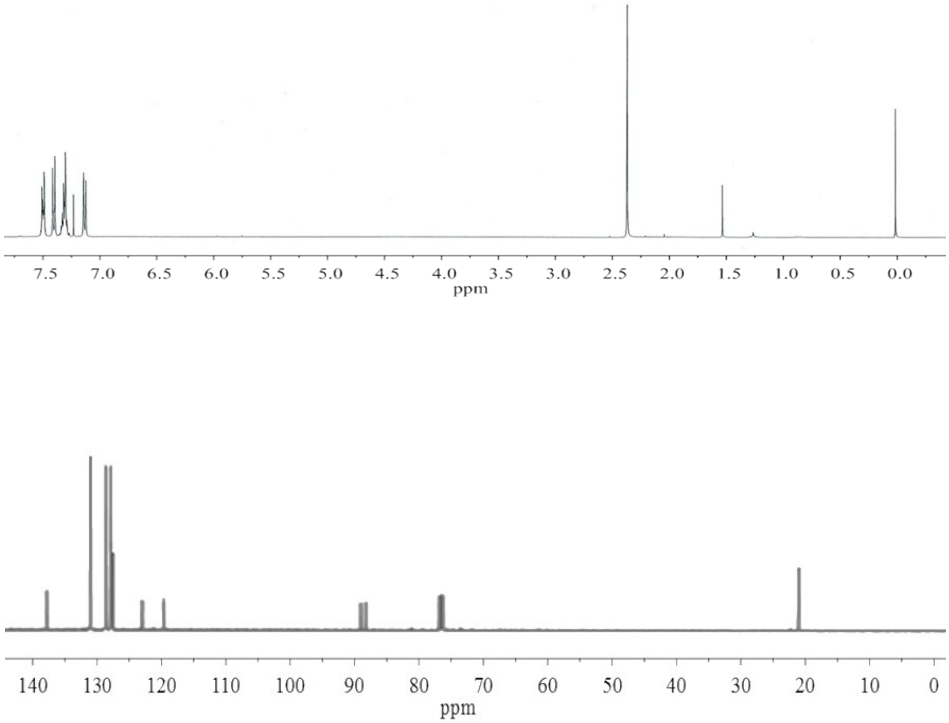
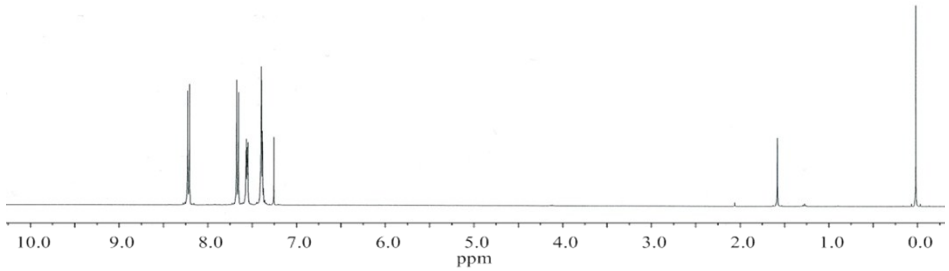
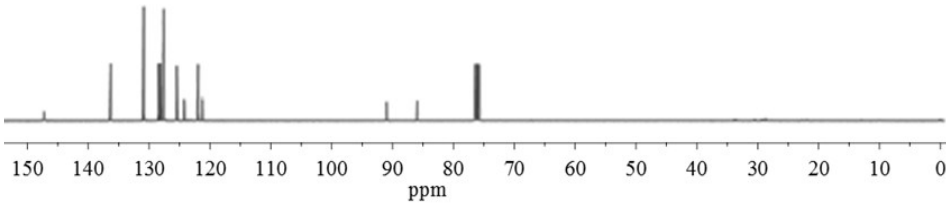
1-Methyl-4-(phenylethynyl)benzene (1b).[2] ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50 (d, 2H), 7.40 (d, 2H), 7.33 (m, 3H), 7.13 (d, 2H), 2.34(s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 20.40, 87.72, 88.51, 119.17, 122.40, 127.02, 127.24, 128.03,130.42, 130.46, 137.32.

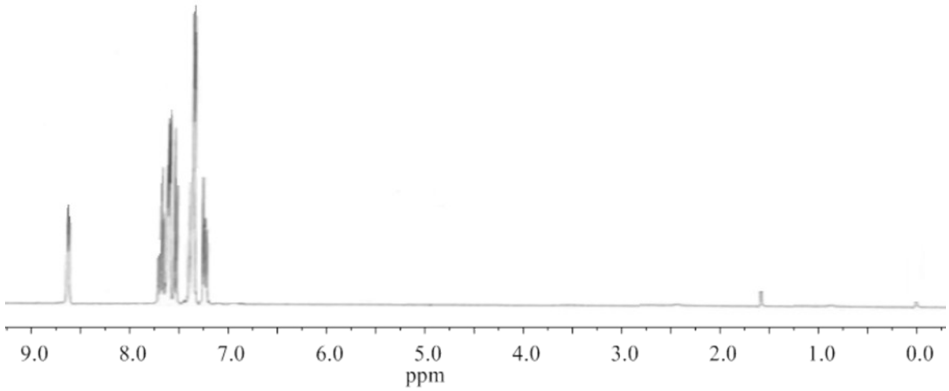


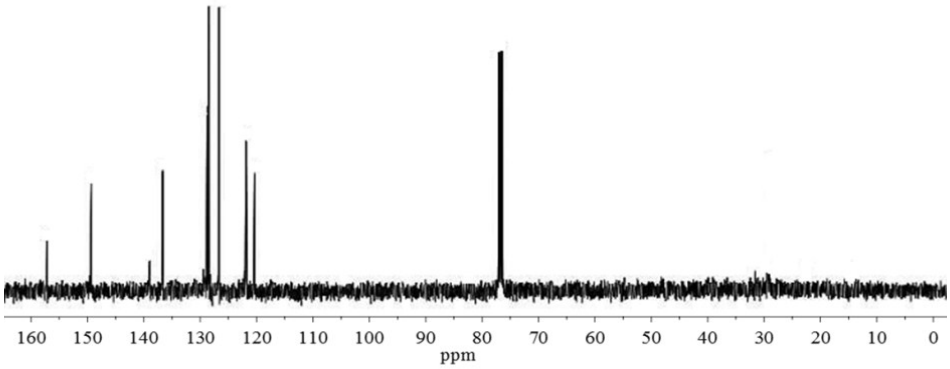
1-Nitro-4-(phenylethynyl)benzene (1c).[3] ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.23 (d, 2H), 7.66 (d, 2H), 7.57-7.54 (m, 2H), 7.42-7.38 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 85.82. 90.91, 121.13, 121.85, 124.10, 125.34, 127.45, 128.03, 128.31, 130.73, 136.15, 147.10.





2-(Phenylethynyl)pyridine (1d).[3] ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.60 (d, 1H), 7.65 (dt, 1H), 7.60-7.58 (m, 2H), 7.54 (d, 1H), 7.37-7.32 (m, 3H), 7.25-7.19 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 120.57, 122.06, 126.89, 128.70, 128.96, 136.83, 139.15, 149.51, 157.32.





References

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