Photochemical Synthesis and Identification of Tetracarbonyl-bis(olefin)metal(0) Complexes of Group VI B Elements

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Photolysis of hexacarbonyl metal(0) or tetracarbonyl-bis(1,3-butadiene)metal(0) (metal: chromium, molybdenum, tungsten) in the presence of tetracyanoethylene, TCNE, or fumaronitrile, FN, at room temperature yields trans-bis(\(\eta^2\)-tetracyano-ethyene)tetracarbonyl-chromium(0) (1), -molybdenum(0) (2), -tungsten(0) (3) and trans-bis(fumaronitrile)tetracarbonyl-chromium(0) (4), -tungsten(0) (5) complexes. The complexes were purified by chromatography and recrystallization and characterized by IR, \(^1\)H, \(^{13}\)C NMR and mass spectroscopies. It is shown that two tetracyanoethylene ligands are symmetrically bonded to the M(CO)\(_4\) moiety through their carbon-carbon double bond in the form of \(\eta^2\)-TCNE. The two fumaronitrile ligands are bonded to the central atom through their nitrogen atoms. The spectral data are discussed in terms of metal → ligand \(\pi\)-interaction.