Synthesis and properties of iron, aluminium and yttrium vanadates

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An aqueous solution containing stoichiometric amounts of metal (Fe, Al and Y) nitrate, ammonium meta vanadate, ammonium nitrate and 3-methyl pyrazole-5-one when heated rapidly at 350°C boils and ignites to yield amorphous metal vanadates in less than 5 min. The products when heated at 650°C for 1 h gave crystalline single phase, MVO₄, where M = Fe, Al and Y. Lattice parameters FeVO₄: \( a = 8.0572(19), b = 9.347(2), c = 6.7138(13), \alpha = 106.6, \beta = 101.53, \gamma = 96.7 \); AlVO₄: \( a = 6.471(1), b = 7.742(1), c = 9.084(1), \alpha = 96.8, \beta = 105.8, \gamma = 101.4 \); and YVO₄: \( a = b = 7.1192, c = 6.2898, \alpha = \beta = \gamma = 90 \) agree well with the literature. Surface area of the vanadates are: FeVO₄-2 m²/g, AlVO₄-7 m²/g and YVO₄-14 m²/g. Average agglomerate size determined by sedimentation technique are 4.59 μm(FeVO₄), 4.82 μm(AlVO₄) and 3.13 μm(YVO₄). Room temperature fluorescence of Eu³⁺ doped YVO₄ shows three bands at 611, 615 and 619 nm due to \( ^5D_0 \rightarrow ^7F_2 \) transitions and emission at 595 nm due to \( ^5D_0 \rightarrow ^7F_1 \) transition.

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