CLAIMS

1 A method of producing an ethylenically unsaturated carboxylic acid or ester, preferably an α, ß ethylenically unsaturated carboxylic acid or ester, comprising the steps of contacting formaldehyde or a suitable source thereof with a carboxylic acid or ester in the presence of a catalyst and optionally an alcohol, wherein the catalyst comprises group II metal phosphate crystals having rod or needle like morphology.

2 A method according to claim 1, wherein the phosphate is selected from hydroxyapatite, pyrophosphate, hydroxyphosphate, PO_4^{2-} phosphate and mixtures thereof.

3 A method according to claim 1 or 2, wherein the group II metal of the phosphate is selected from Ca, Sr or Ba or mixtures thereof.

4 A method according to any of claims 1 to 3, wherein the catalysts are selected from strontium hydroxyapatite and calcium hydroxyapatite.

5 A method according to any of claim 1 to 4, wherein the catalyst is at least 50% w/w metal phosphate.

6 A method according to any of claims 1-5, wherein the catalyst of the invention has its surface layer of crystals depleted below the hydroxyapatite metal to phosphate mole ratio of 1.67.

7 A method according to claim 6, wherein the crystal surface metal:phosphorus (M:P) mole ratio is between 1.30 and 1.55.

8 A catalyst system comprising a crystalline group II metal phosphate catalyst and a catalyst support wherein the group II metal phosphate has rod and/or needle like morphology.

9 A method according to any of claims 1-7, wherein the carboxylic acid or ester reactant of the present invention is of formula R^3-CH_2-$COOR^4$, wherein R^4 is either hydrogen or an alkyl group and R^3 is either hydrogen, an alkyl or aryl group.

10 A method according to any of claims 1-7, or 9 wherein the ethylenically unsaturated acid or ester produced by the process of the invention is selected from acrylic, alkacrylic, 2-butenoic, cyclohexenoic, maleic, itaconic and fumaric acids and their alkyl esters, and also methylene substituted lactones.

11 A method according to any of claims 1-7, 9 or 10, wherein doping elements are present in the catalyst at a level up to 20 mol % of the metal M.

12 A method according to claim 11, wherein the doping elements are metal cations ~~are~~ selected from Cs, K, Rb, Na, Li, Zn, Ti, Si, Ln, Ce, Eu, Mg (if not used as a group II metal), Ba(if not used as a group II metal), Pb, Cd, Ag, Co, Cu, Ni and Zr.

13 A method according to any of claims 1-7, or 9-11, wherein doping anions are present in the catalyst at a level of up to 20 mol % phosphate.

14 A method according to claim 13, wherein the doping anions are selected from carbonate, chloride and fluoride.

15 A method or catalyst system according to any preceding claim wherein the catalyst is on a support selected from alumina, silica, silicon nitride, silicon carbide, colloidal silica, titania or aluminium phosphate.

16 A method according to any of claims 1-7, or 9-15, wherein the metal:phosphorus (M:P) mole ratio is between 0.8-1.8.