Name of the Scholar: Qamer Faisal

Name of the Supervisor: Dr. Rabia Ahmad

Department: Chemistry

Title of the thesis: Study of some solid-solid reaction with dry and moistened reactants

ABSTRACT

The main objective of the research work is to find out the dependence of the product formation at early times on the physical parameters of the concerned reactants and impurities, if the reactants are mixed with small amounts of the impurities. The study is largely of ionic reactants. Most of the studies involve capillary reactions but some bulk studies have also been carried out.

Brief outline of chapters of the thesis:

This chapter of the thesis is an Introduction to solid-solid reactions, with special reference to those discussed in this thesis. Chapter-II provides justification of capillary studies for the determination of order of the reaction, rate constant and activation energy of solid-solid capillary reactions. Chapter-III is a study of solid-solid capillary reactions when one of the reactants is kept same and the other reactant is changed, one by one. It leads to interesting results and conclusions. Chapter-IV is a study of solid-solid capillary reactions in the presence of different inorganic and organic solid impurities for the same pair of the two reactants. The plausible picture of solid-solid reaction proposed in the earlier chapter gets further support. Chapter-V is a study of solid-solid capillary reactions in the presence of different organic solvent impurities for the same pair of the two reactants. Chapter-VI is the formation of some new products when the solid-solid capillary reaction takes place in the presence of organic solvent impurities. The finding are tentative, requiring further work. Chapter-VII is a study of thermal curves of solid-solid reactions in bulk, pure as also when inorganic solid, organic solid as also when organic solvent impurities are used, one by one, for the reactant systems. The plausible picture of the solid-solid reaction receives further support from this. Chapter-VIII is

a study of some fats, oils and juices using solid-solid capillary reactions for two systems. The study helps in classifying and sub-classifying these mixture of compounds. Chapter-IX is a study of solid-solid capillary reactions using nano-reactants, for pure reactants as also when the reactants are moistened with double distilled organic solvent impurities. In the pure case, the product is much larger with the nano-reactants. With organic solvent impurities, the product has a direct dependence on the value of the electric dipole moment of the organic solvent molecule. The results suggest that the study leads to telling whether for the pure case, the inorganic ionic reactant is in nano-form or not, or rather in relatively enhanced nano-form or not. Further, nano-reactant systems can also be used for measuring the electric dipole moment of organic solvents. It may be suggested that same may be the case for inorganic solid impurities. The plausible picture of the solid-solid reaction receives a great boost from this study. In Chapter-X, most of the data required in this research work has been put at one place. It also gives some semi-empirical formulae that enable one to express the dependence of the cohesive energy and the vapour pressure only on one parameter, say, the nearest neighbour distance, or if we want on the electric dipole moment of many compounds (in our case, the alkali halides).

Scope of the research work

Thus on the basis of the whole research work, it can be said that, the most important conclusion of this thesis is that the solid-solid reactions between the compounds studied here start mostly, at the molecular level. The two most important physical quantities seem to be the thermal vapour pressure and the electric dipole moment. The reaction can be used for the study of inorganic and organic impurities. Most important of all the field is waiting for the input of nano-materials in a big way. It has already entered in some of the specialized reactions. The work indicates the great importance of nano-reactants and nano-impurities for the solid-solid reaction studies. All different Characterization of the product will be a crucial step that would be taken in future.

A simple formula for the cohesive energy of the alkali halides is proposed and put into use. A simple theoretical understanding of ionic compounds has been achieved by this study.