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Research Article

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Study of Phase Equilibrium in the Binary Sentence of Sodium Metafanadate with Calcium Molybdate $NaVO_3$-$CaMoO_4$

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Abstract In this research study phase equilibrium in bilateral Wholesale ($NaVO_3$-$CaMoO_4$) in vitro (in the laboratories of the Faculty of Science), where is the concept of phase transitions, the basis for many of the natural sciences chemistry , physics and biology, which is the premise of science engineering, mechanical and electrical such as engineering and materials engineering. Transitions are considered the metaphase common in nature, it has benefited rights in the development and improvement of old materials, which was able to elaborate the phase transitions unfamiliar (Fluid high, conductivity high, glass metals) and in which they can solve many of the technical problems that were facing the technology, and this is still the door open as long as the will to improve life on the basis of scientific progress exist. When examining any material changes within the stages, studying the so-called scheme of ?? balance or eccentric scheme, since the material balance energy Minimal when changing variables Altermdinamekih. Practically impossible to reach a state of equilibrium, lies the importance of research to obtain crystalline compounds in the binary strings of dead sodium vanadate with calcium molybdate what these salts from the properties of the quality in the areas of technology, so it was important to study the possibility of obtaining new phases at different Molar ratios and fee balances schemes her eccentric. Especially since the salts derived for the study have different crystalline structures and can therefore predict that the outputs of the study will be important and good. This study shows form the core of a solution on the basis of calcium molybdate where dissolved sodium molybdate Metafanadat in calcium up to 40% of sodium Metafanadat

Keywords Metafanadat sodium, calcium molybdate, phase diagram, solid solution

Introduction

Modern technical studies have been interested in the production of solid crystalline compounds since the beginning of the twentieth century because of their wide applications and great importance in the various technical fields such as the preparation of ceramics and materials of fusion and in the production of crystalline compounds that have qualitative electrical qualities such as electric capacitors or other electrical properties such as piezo electric and Skeneto Electric or Preparation of electric conveyors or production of compounds in various mining fields such as the preparation of mixtures with specific mechanical, physical and chemical specifications [1-3].
Therefore, modern studies have tended to prepare these compounds, either from the interactions of solid crystalline elements with each other or the preparation of products of oxides or salts, based on these reference studies we will address with regard to our research, which includes the study of phases in the crystalline sentence of calcium

molybdate with sodium Metafanadat on the basis of the phase equilibrium in binary sentences. Which is given by the following relationship:

$$F + \Phi = K + n$$

Where F: number of degrees of freedom

Φ: number of crystalline phases

K: number of vehicles

n: external conditions of pressure and temperature (T, P).

We can obtain new crystalline compositions at different molar ratios and varying temperatures, especially as the salts taken have qualitative and varied characteristics of which permanent magnets are prepared or used as strong oxidizers or electrical savings or can be used in technical technological fields in the fields of medicine or other areas in Industry (dyes, paints .....) [4-7] .The concept of phase transformations, is the basis for many natural sciences, such as chemistry, physics and biology, from which is the starting point of engineering sciences such as mechanical and electrical engineering and materials engineering. Phase transformations are common in nature [8-10].

Research Importance

The importance of research is to obtain crystalline compounds in the binary sentences of sodium Metafanadat with calcium molybdate because these salts have specific qualities in the fields of technology. Especially since the salts taken for the study have different crystalline structures and therefore can be expected that the results of the study will be important and good**.**

Research Aims

Preparation of different compounds in the binary sentence at different molar ratios according to the following steps:

1. Preparation of mixtures at different molar ratios.
2. Study of some physical properties of these mixtures.
3. Draw a phased balance chart for the studied sentence.

Research Methods and Materials

1. Sample Preparation

Nine samples were prepared according to different molar ratios according to the following steps (the weight of each sample is 3 gram).

- Calculate the molecular weights of each compound in each sample according to the molar ratios as follows:

Molecular Weight of Calcium Molybdate 200.01.

Molecular Weight of Sodium Metafanadate 121.93.

Weight of Sodium Metafanadate 121.93.

The first sample: the proportion of calcium molybdate in which 10% the percentage of sodium metafanadate is 90%, the composition of the sample according to the following formula: $1CaMoO_4,9NaVO_3$

$200.01 \times 1 + 121.93 \times 9 = 1297.38$ gr

200.01÷ 1297.38 = 0.154 gr

$121.93 \times 9 \div 1297.38 = 0.845$ gr

Weight of calcium molybdate in the first sample o.154 gr.

The weight of sodium metafanadate in the second sample was 0.845gr.

Thus the weight of calcium molybdate and sodium metafanadate in the nine samples is calculated according to the molar ratios taken as shown in Table (1).

Table 1: The weight of calcium molybdate and sodium metafanadate in the samples

Sample Number	Ratio $CaMoO_4$ in the sample %	Weigh $CaMoO_4$ in the sample gr	Ratio $NaVO_3$ in the sample %	Weigh $NaVO_3$ in the sample gr
1	10	0.154	90	0.845
2	20	0.290	80	0.709
3	30	0.412	70	0.587
4	40	0.522	60	0.477
5	50	0.620	50	0.378
6	60	0.711	40	0.288
7	70	0.792	30	0.207
8	80	0.867	20	0.132
9	90	0.936	10	0.063

Results and Discussion

1) Study of thermal changes in differential thermostats (DTA)

The nine samples were studied using DTA and the results were as follows Figures (1) to (9) illustrate the DTA and TG curves of the studied samples.

-DTA spectrum for the first sample consisting of 90% sodium metafanadate and 10% calcium molybdate as shown in Figure (1).

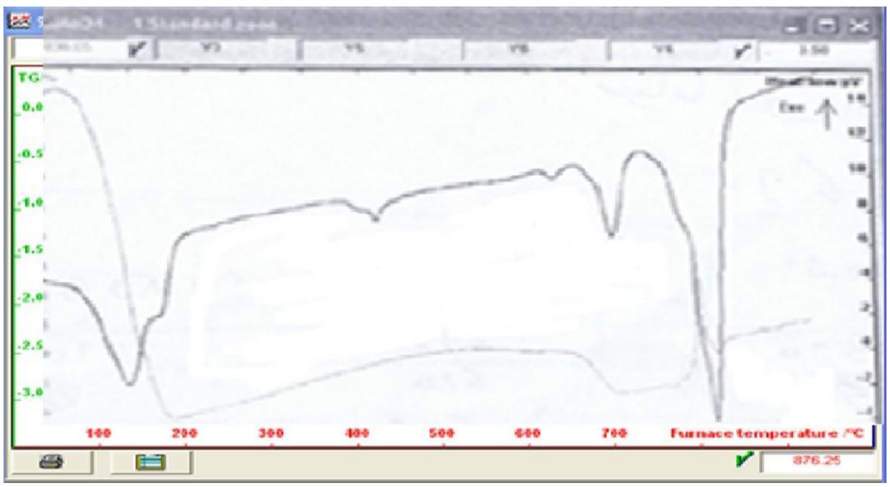

Figure 1: DTA curve for the first sample (10% calcium molybdate - 90% sodium metafanadate)

-DTA spectrum of the second sample consisting of 80% sodium metafanadate and 20% calcium molybdate as shown in Figure (2)**:**

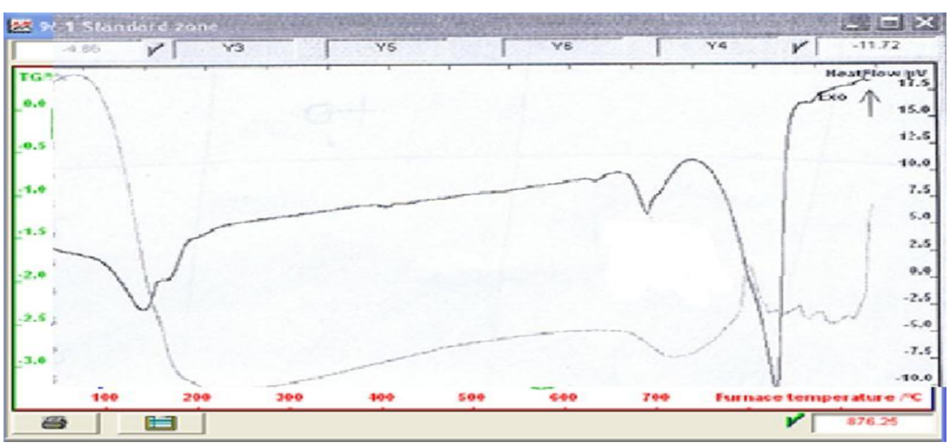

Figure 2: DTA curve for the second sample (20% calcium molybdate - 80% sodium metafanadate)

- DTA spectrum of the third sample consisting of 70% sodium metafanadate and 30% calcium molybdate as shown in Figure(3):

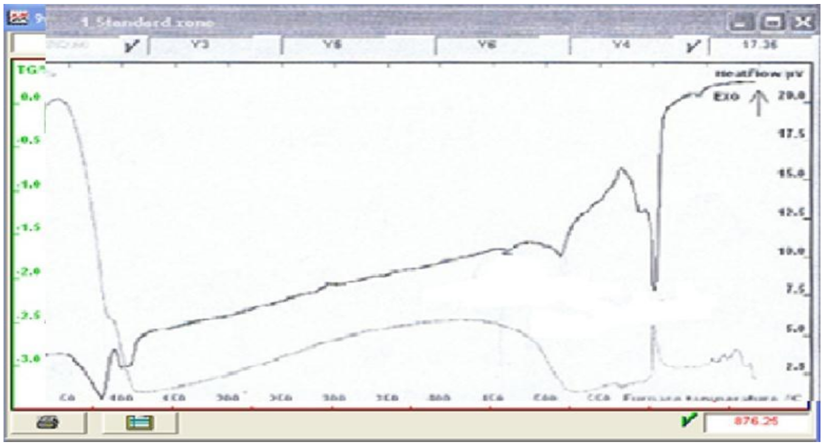

Figure 3: DTA curve for the third sample (30% calcium molybdate - 70% sodium metafanadate)

- DTA spectrum of the fourth sample consisting of 60% sodium metafanadate and 40% calcium molybdate as shown in Figure (4).

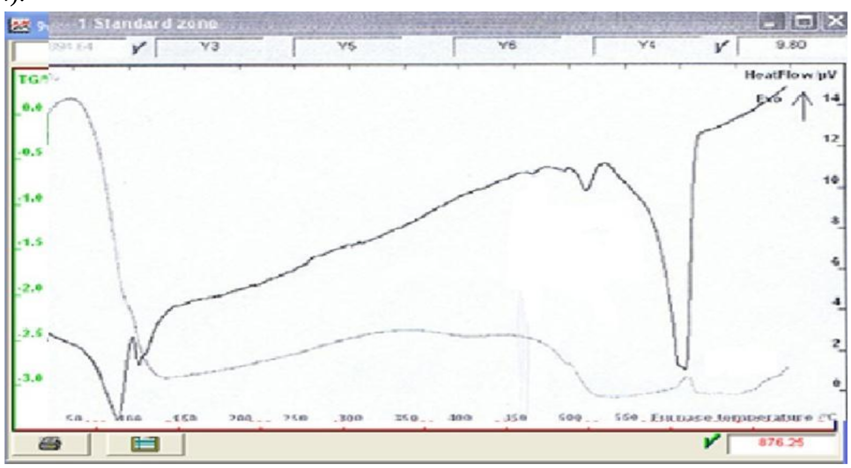

Figure 4: DTA curve for the fourth sample (40% calcium molybdate - 60% sodium metafanadate)

-The DTA spectrum of the fifth sample consisting of 50% sodium metafanadate and 50% calcium molybdate as shown in Figure(5):

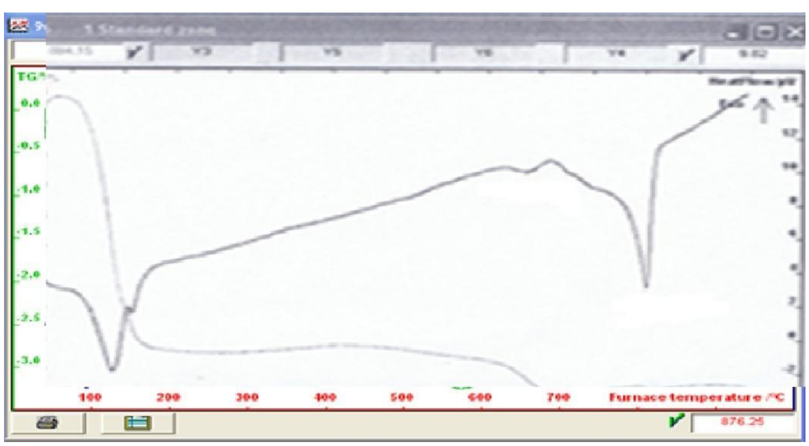

Figure 5: DTA curve for the fifth sample (50% calcium molybdate - 50% sodium metafanadate)

- The DTA spectrum of the sixth sample consisting of 60% sodium metafanadate and 40% calcium molybdate as shown in Figure(6):

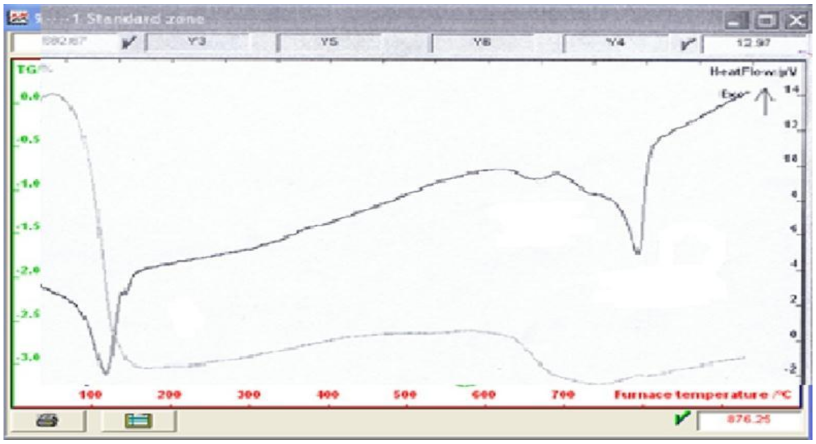

Figure 6: DTA curve for the sixth sample (60% calcium molybdate - 40% sodium metafanadate)

- DTA spectrum of the seventh sample consisting of 70% sodium metafanadate and 30% calcium molybdate as shown in Figure(7):

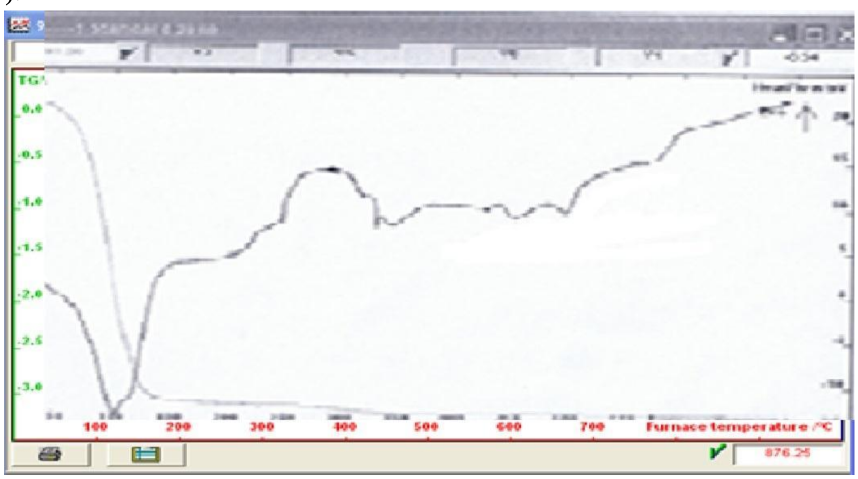

Figure 7: DTA curve for the seventh sample (70% calcium molybdate - 30% sodium metafanadate)

- The DTA spectrum of the eighth sample consisting of 80% sodium metafanadate and 20% calcium molybdate as shown in Figure(8):

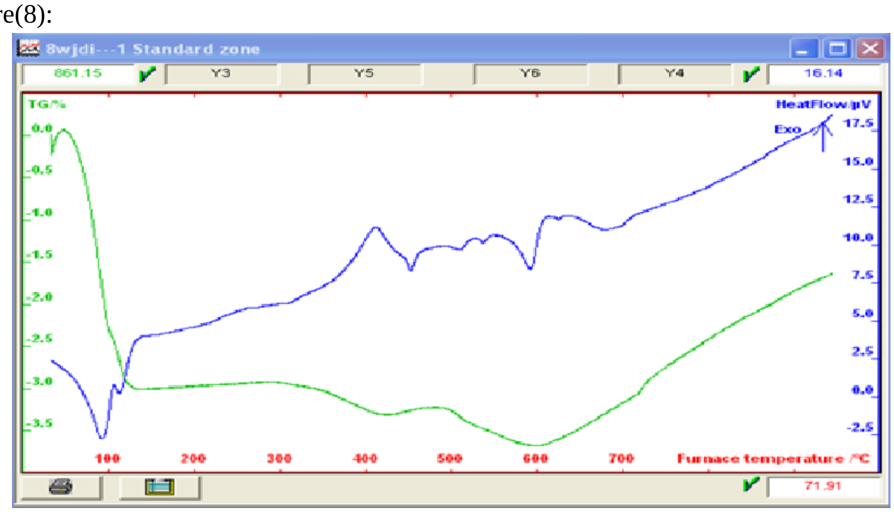

Figure 8: DTA curve for the eighth sample (80% calcium molybdate - 20% sodium metafanadate)

- The DTA spectrum of the ninth sample consisting of 90% sodium metafanadate and 10% calcium molybdate as shown in Figure(9):

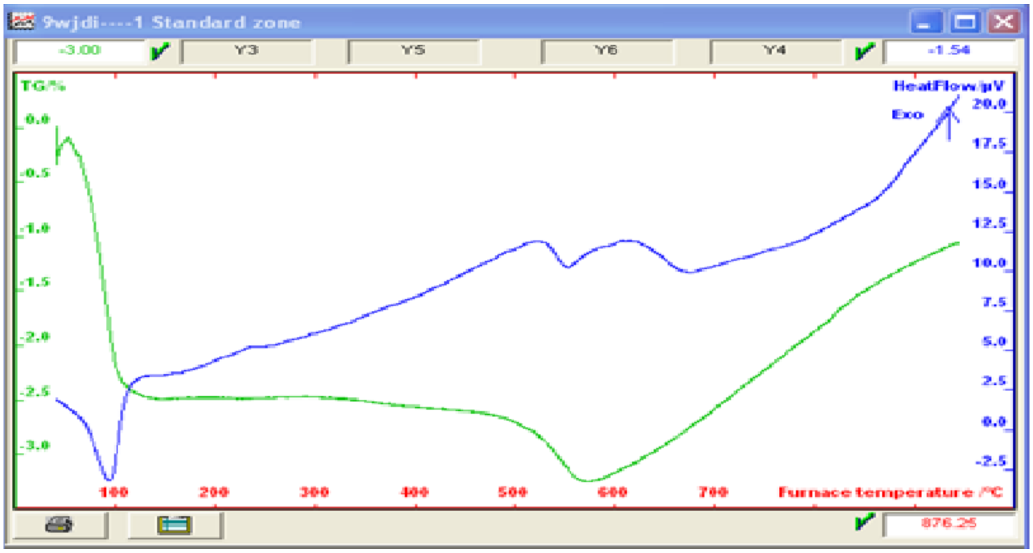

Figure 9: DTA curve for the ninth sample (90% calcium molybdate - 10% sodium metafanadate)

2) X-ray spectrometer

The nine studied samples were studied in addition to the sodium metafanadate and calcium molybdate spectra using XRD diffraction device. The results were as follows:

1. Form a solid solution based on calcium molybdate, as the dissolution of sodium metafanadate in calcium molybdate up to 40% of sodium metafanadate.

2. The remaining spectra above 40% represent two phases in equilibrium, namely sodium metafanadate and calcium molybdate. As shown in the two figures(10) and (11):

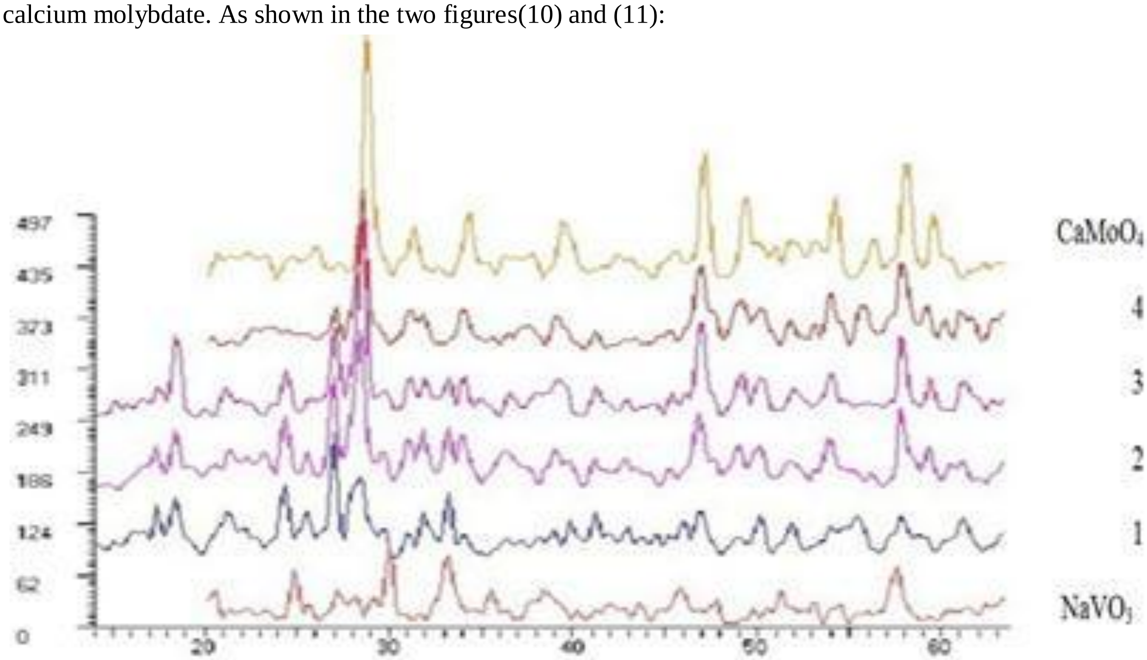

Figure 10: XRD spectra of samples in which a solid solution is formed

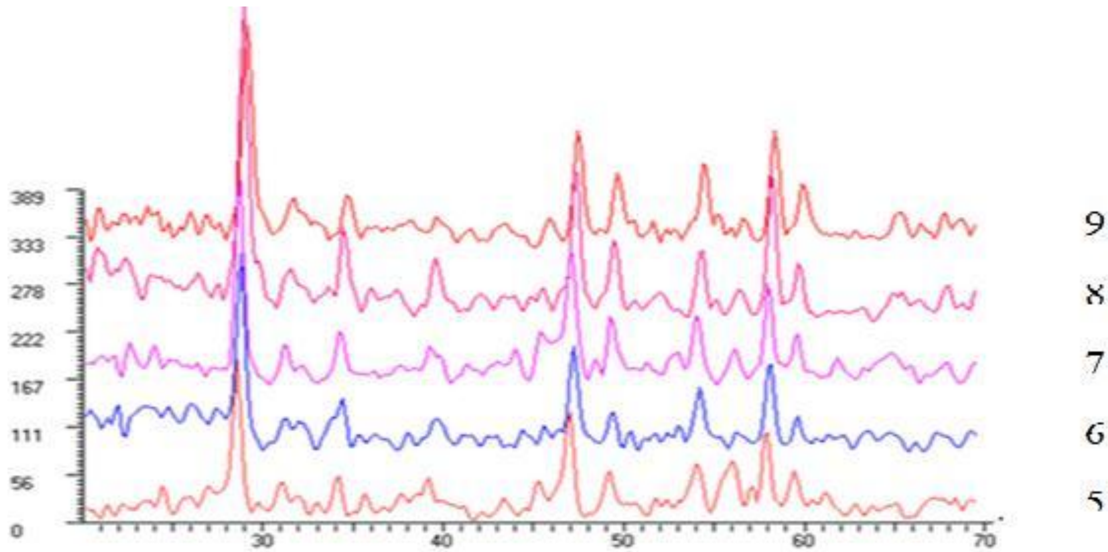

Figure 11: The XRD spectrum for samples where two phases are in equilibrium

Conclusions

- We observe from the X-ray spectra form a solid solution as dissolving sodium metafanadate in calcium molybdate up to 40% of sodium metafanadate and form a solid solution in this sentence conforms to the conditions necessary to form a solid solution, namely:
- Unlimited solid solution is formed if the difference between the radii is less than 15% and if the difference is greater than this value a limited solid solution is formed. In this study the difference between the radii is 31%.

$$r = r_{Ca}-r_{Na} = 1.97-1.66 = 0.31 * 100 = 31\%$$

- The solubility is limited between two elements, one with high electronegativity and the other with low electronegativity.
- Limited decomposition occurs if the compounds have different crystalline models.
  In this study, the two compounds have a different crystalline structure.
- $NaVO_3$ sodium metafnadate has a monoclinc structure (a=5.034 A^0, b= 10.768A^0, c=5.108 A^0, B=90.86A^0).
- We note from the DTA schemes that there are phase transformations up to 40% of sodium metafanadate, and these phase transformations are caused by the presence of solid solution formed.

Recommendations

This experiment is being circulated to some establishments as they may achieve technological developments.
The physical, chemical, electrical, mechanical and optical properties of the solid solution formed can be studied.

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