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Jointly organized by:

Automation, Computer Science and Technology Department, Kryvyi Rih National University, Ukraine
'Research Culture Society'

and

'Scientific Research Association'

Conference Special Issue - 31

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The Managing Editor:

Dr. Chirag M. Patel

(Research Culture Society & Publication)

Jointly Organized By :

**Automation, Computer Science and Technology
Department, Kryvyi Rih National University, Ukraine**

Research Culture Society

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Eurasian Conference on Science, Engineering & Technological Innovation

20 & 21 Nov, 2021

(Conference – Special Issue)

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About the organizing Institutions:

Kryvyi Rih National University is one of the largest education institutions of the central region of Ukraine for qualified personnel training in metallurgical, mining, engineering and technological specializations. Scientific subjects performed by the university aimed to increasing the efficiency of production and control processes, power saving and environmental protection.

Automation, Computer Science and Technology Department

ACST department trains specialists in computer science, automation and computer-integrated technologies. The main educational and scientific areas are: information support for decision making, , development and implementation of process automation and mechatronics systems.

‘Research Culture Society’ is a Government Registered Scientific Research organization. Society is working for research community at National and International level to impart quality and non-profitable services. Society has successfully organized 100+ conferences, seminars, symposiums and other educational programmes at national and international level in association with different educational institutions.

Objectives of the International Conference :

Our main objective is to promote scientific and educational activities towards the advancement of common citizen’s life by improving the theory and practice of various disciplines of science and engineering. The aim of the conference is to provide an interaction stage for researchers and practitioners from academia and industries to deal with state-of-the-art advancement in their respective fields.



KRIVYI RIH NATIONAL UNIVERSITY

Prof. Natalia Morkun

Head of Department of Automation,
Computer Sciences and Technologies

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MESSAGE

Dear Colleagues!!!

I am proud to be the part of Organizational Committee of two-day International online “Eurasian Conference on Science, Engineering & Technological Innovations - 2021”, jointly organized by ‘Research Culture Society’, ‘Scientific Research Association’ and Department of Automation, Computer Sciences and Technologies, Kriviy Rih National University (20 & 21 Nov, 2021).

We have an exciting program at this conference that will allow participants to reflect upon and celebrate their accomplishments, renew friendships and extend networks, and jointly explore current and future research directions. I hope that all participants will have a productive and fun-filled time at this online conference.

I sincerely hope that this conference will deliberate and discuss all the different facets of this exciting topic and come up with recommendations that will lead to a better world.

I wish the conference great success.

Prof. Natalia Morkun



Message

Dear Professional Colleagues.

I am happy that Automation, Computer Science and Technology Department, Kryvyi Rih National University, Ukraine in collaboration with 'Research Culture Society' (Government Registered Scientific Research organization, India) are organizing 'Eurasian Conference on Business, Management, Social and Economical Advancements' during 20 & 21 Nov, 2021.

The aim of the conference is to provide an interaction stage for researchers, practitioners from academia and industries to deal with state-of-the-art advancement in their respective fields. The main objective is to promote scientific and educational activities towards the advancement of common citizen's life by improving the theory and practice of various disciplines of science and engineering. Provide the delegates to share their new ideas and the application experiences face to face.

I believe, this International Conference will help in redefining the strong connection between science, engineering and technology students and academicians from different institutions. An additional goal of this international conference is to combine interests and scientific research related to basic, applied and allied sciences, engineering and technology to interact with members within and outside their own disciplines and to bring people closer for the benefit of the scientific community worldwide.

My best wishes to the committee members, speakers and Participants of this scientific conference.

A handwritten signature in blue ink, appearing to read 'Dr. C. M. Patel', is positioned above the printed name.

Dr.C. M. Patel

Director, Research Culture Society.

Conference Committee

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Dr.C. M. Patel, Director, Research Culture Society.

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Dr. Pokkuluri Kiran Sree, Professor, Dept. of CSE, Sri Vishnu Engineering College for Women, Bhimavaram, India.

Dr. Jessica Chocha, Assistant Professor, Bhauddin Science College, Junagadh, Gujarat, India

Keynote Speakers:

GAGIK SHMAVONYAN (Ph.D), Professor & Research Scientist, National Polytechnic University of Armenia, Department of Microelectronics and Biomedical Devices, Yerevan, ARMENIA Research Scientist, Institute for physical research (IPR), Solid state physics Laboratory, NAS Armenia, Ashtarak-2, ARMENIA.

Dr. Amit Parikh, Professor & Principal, Mehsana Urban Institute of Sciences, Ganpat University, Gujarat, India.

Dr. Shailesh Shah, Associate Professor, Faculty of Tech & Engineering, The Maharaja Sayajirao University of Baroda., India

Dr. M. Narayani, Associate Professor & Vice Chancellor, Harvest University, Zambia, Africa.

Rania Lampou, STEM instructor and an ICT teacher trainer, the Greek Ministry of Education - the Directorate of Educational Technology and Innovation, Greece.

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Dr. Sanjay Gaur, Associate Professor, Jaipur Engineering College & Research Center, Jaipur, India.

INDEX

PAPER ID	Table of Contents	Page No.
a)	About the organizing Institutions: Objectives of the International Conference :	3
b)	Message of HOD, Automation, Computer Sciences and Technologies, Kriviy Rih National University, Ukraine	4
c)	Message of Director, Research Culture Society.	5
d)	Conference Committee	6
e)	Keynote Speakers	7
f)	Table of Contents	8
	Paper Title & Author Name	
ECSETI01	Biological Importance of Selenosemicarbazone -- Rinku Malhi	9-16
ECSETI02	Undergraduate Chemistry Students' Perspective about Flipped Learning on solving Organic chemistry problems: A Case Study - - Dr. Sajith S.	17-19
ECSETI03	AMELIORATIVE EFFECT OF ANNONA MURICATA LEAF EXTRACT ON FIPRONIL INDUCED BIOCHEMICAL AND HISTOLOGICAL CHANGES IN OREOCHROMIS MOSSAMBICUS -- Reena Michael, Dr. M. L. Joseph	20-45
ECSETI04	Study of coordination behaviour of some pyrazine derivative -- Shailesh Kumar, Alok kumar and Bijay kumar	46-50
ECSETI05	ANNEALING EFFECT ON CHARACTERISTICS OF NICKEL-TUNGSTEN ALLOY THIN FILMS -- Dr. T. Baskar ; Dr.A.Shaji George	51-55
ECSETI06	Education Data Mining: Future Prospects and Potential Benefits -- Mr. Rajinder Kumar, Dr.Garima Bansal	56-63
ECSETI07	Heart Rate Measurement from Fingertip Using Microcontroller -- Borchala Namomsa Dareje	64-70
ECSETI08	Analysis of Frequently Failed Transmission Lines in India and Innovative Solutions for the Better Operation and Maintenance of the Towers -- Malar Kodi, Naqui Anwer and M. Tamil Selvan	71-77

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ANNEALING EFFECT ON CHARACTERISTICS OF NICKEL-TUNGSTEN ALLOY THIN FILMS

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Abstract: *Electroplating at room temperature was used to create NiW alloy thin films. After that, the electroplated NiW thin films were annealed at 200 degrees Celsius. The texture of NiW deposited films is oriented in the FCC phase. Morphological, structural, and mechanical characterizations were performed on them. On the surface, NiW films were brilliant and uniformly covered. NiW film deposition were also nanoscale, with an average crystalline size of roughly 92 nm. After annealing, the micro hardness of NiW was 138 VHN.*

Keywords: *Electroplating, electrolytic bath, crystalline size, VSM, Ni-P, X-ray diffraction, VHN, SEM.*

1. INTRODUCTION:

MEMS devices such as tiny actuators, sensors, micro motors, and frictionless micro gears require soft magnetic materials. Ferromagnetic films and alloys have unique features compared to non-magnetic films and alloys due to their use in magnetic storage media, magnetic sensors, and other applications [1-4]. Ni-Fe, Ni-W, and Co-Fe alloys have been widely employed due to their low coercivity and high saturation magnetization. Because the crystal structure of Ni-W alloys has the greatest influence on their magnetic properties, a detailed examination of this engineering substance is required for its application areas [5-8]. Several tests on the effects of various deposition parameters on the magnetic characteristics of Ni-W films have been undertaken in recent years by scientists. Nickel and its alloys have a number of advantages, including excellent wear and corrosion resistance [9-12]. As a result, in the industry, nickel deposition is required to improve wear and corrosion resistance as well as magnetic characteristics. Electrochemical techniques, such as electrodeposition and electroless deposition, are ideally adapted to meet high yield and low cost criteria [13-14]. The effects of annealing on NiW films were investigated in this work.

2. EXPERIMENTAL PART:

Electrodeposition of NiW alloy films were prepared with electrolyte baths consisting Sodium tungstate (15 g/l), Nickel sulphate (30 g/l), Ammonium sulphate (40 g/l), Boric acid (10 g/l), and Saccharin (10 g/l) and operating at temperature (30 °C). The deposition process took 15 minutes

to complete. Copper and stainless steel substrates with dimensions of 1.5 cm x 7.5 cm were used as cathode and anode in this study [6-8]. By adding ammonia solution, the pH of the electrolytic solution was set to 6.0, and the electroplating procedure was carried out with a current density of 3 mA/cm². After 15 minutes, the copper or cathode was gently removed from the bath and dried for a few minutes [10-14]. Then electroplated NiW thin films was annealed at 200 °C. Scanning Electron Microscope was used to describe the surface nature of NiW films. Energy-dispersive X-ray spectroscopy was used to look at the atomic composition of film deposits, and X-ray diffraction was used to look at the crystal structure of the deposits. Vickers Hardness Test was used to determine the micro hardness of the films.

3. RESULTS AND DISCUSSION:

3.1 ELEMENTAL COMPOSITION OF NiW THIN FILMS

The elemental composition of NiW films was determined by EDAX analyser. The obtained data by this analyser are shown in Table 1. From result, after annealing , tungsten increased and nickel decreased .

Table 1: EDAX analysis of thin films

S. No	Condition	Ni Wt%	W Wt%
1.	NiW (30°C)	72.21	27.79
2	NiW (Annealed 200°C)	68.45	31.55

3.2 MORPHOLOGICAL OBSERVATION

Surface appearance of NiW thin films at 30°C and annealed thin film were analysed by Scanning Electron Microscope (SEM) images and they are shown in Fig 1. The thin films are bright and uniformly coated on the surface. They are crack free by appearance.

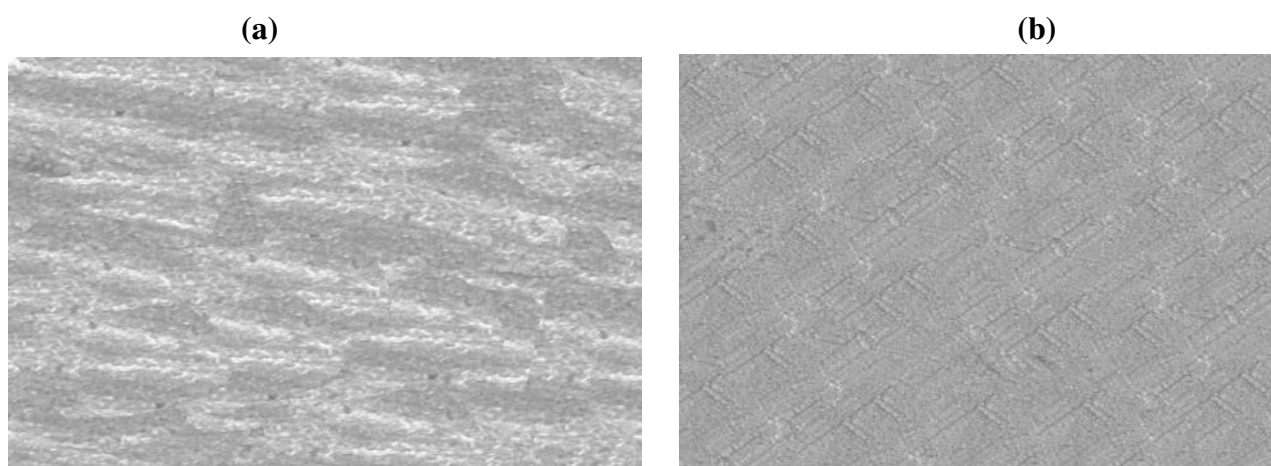


Figure 1. SEM images of thin films (a) NiW (30°C) (b) NiW (Annealed 200°C)

3.3 STRUCTURAL CHARACTERS

Structural characteristic (from XRD Data) results of deposited materials prepared with temperature 30°C and annealed thin film are shown in figure 2. From XRD pattern of NiW, crystal formation of deposits can be concluded. The size of crystals of can be determined by formula

$$\text{Crystal Size (D)} = (0.955 \lambda) / \beta \cos \theta$$

Where, β is FWHM at 2θ , λ is wavelength of incident light. The XRD results of NiW films have shown face centred cubic phase with three diffraction peaks. The nano crystallite deposits was obtained

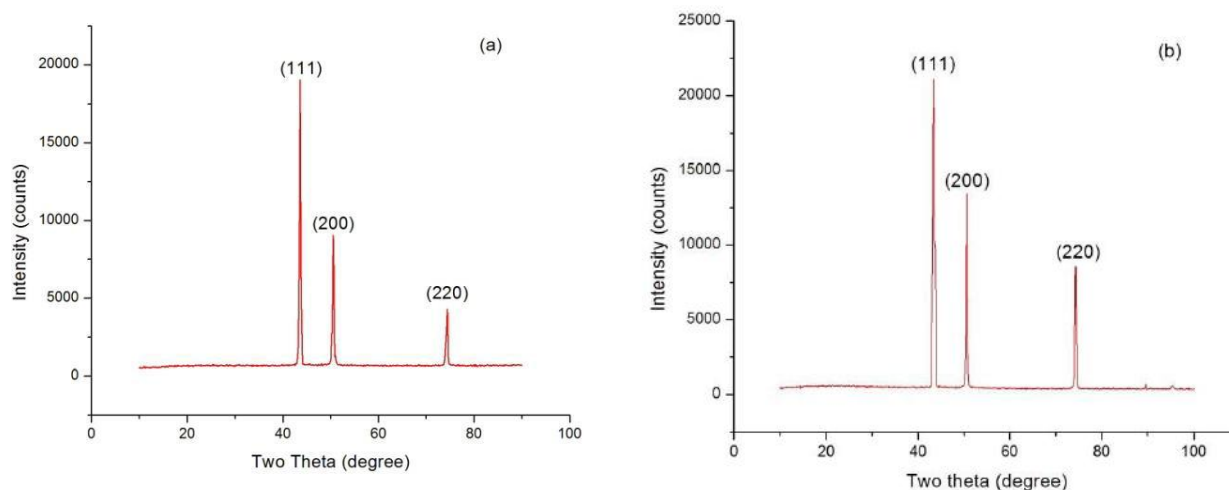


Figure.2. XRD patterns (a) NiW (30°C) (b) NiW (Annealed 200°C)

The crystallite sizes of NiW deposits are tabulated in table 2. Annealing process decreases the crystal size.

Table.2: NiW alloy films -Structural properties

S.No	Condition	2 θ (deg)	d (Å ⁰)	Particle Size(D) (nm)
1	NiW (30°C& without Adenine)	43.47	1.6012	95.67
2	NiW (Annealed 200°C)	42.74	1.6512	89.04

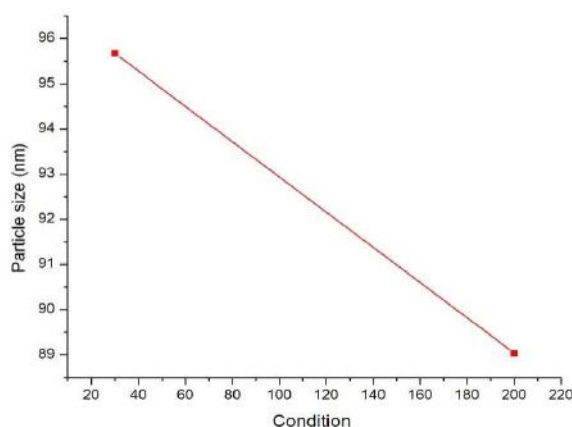


Figure.3. Particle size changes with condition

3.4 MECHANICAL PROPERTIES

Micro hardness measurement of deposits was done by Vickers hardness tester. The hardness values of thin films at room temperature 30°C and annealed thin film are shown in table 3. Annealing process increases the hardness, because of onset formation of crystal deposits during electro deposition process.

Table.3: NiW alloy films -Hardness

S.No	Condition	Hardness VHN)
1	NiW (30°C)	124
2	NiW (Annealed 200°C)	138

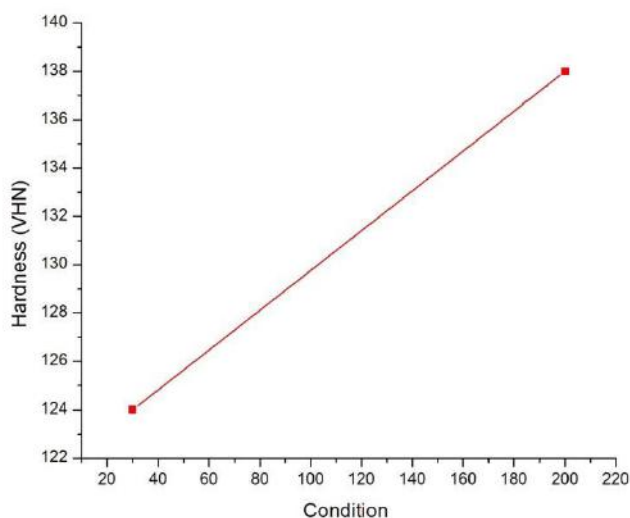


Figure.4. Hardness changes with condition

4. CONCLUSION :

An alloy thin films NiW has been prepared by electro deposition method. The characteristics of NiW films were observed. From EDAX result, tungsten increased and nickel decreased after annealing. The XRD results of NiW films have shown face centred cubic phase with three diffraction peaks. The thin films prepared with annealing process are bright and uniformly coated on the surface. They are crack free by appearance. The hardness values of thin films after annealing process increases .

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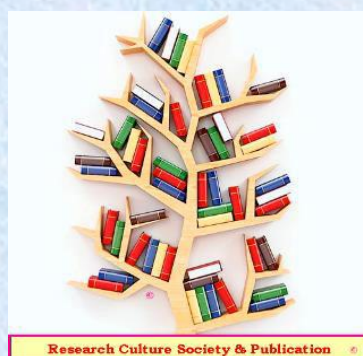
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