REPORT DOCUMENTATION PAGE

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Final Report: Acquisition of an X-Ray Photoelectron Spectroscopy System for Interdisciplinary Research and Education in Multi-Scale Materials at University of Texas Pan American

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W911NF-14-1-0100

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
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6. AUTHORS

Waseem Haider

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES AND ADDRESSES

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12. DISTRIBUTION AVAILIBILITY STATEMENT

Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT

K-Alpha X-ray Photoelectron Spectrometer (XPS) System with an extended warranty was purchased from Fisher Scientific Company, LLC. which has been or will be used in the following research/teaching projects:

1) Development of corrosion-resistant and biocompatible biomedical materials
2) Development and understanding of nanofibers and nanofiber based composites
3) Thin films

15. SUBJECT TERMS

Final Report, X-Ray Photoelectron Spectroscopic

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Waseem Haider
UU	UU	UU	UU		19b. TELEPHONE NUMBER: 956-665-3691

Standard Form 298 (Rev 8/98)
Prescribed by ANSI Std. Z39.18

Report Title

Final Report: Acquisition of an X-Ray Photoelectron Spectroscopy System for Interdisciplinary Research and Education in Multi-Scale Materials at University of Texas Pan American

ABSTRACT

K-Alpha X-ray Photoelectron Spectrometer (XPS) System with an extended warranty was purchased from Fisher Scientific Company, LLC. which has been or will be used in the following research/teaching projects:

1) Development of corrosion-resistant and biocompatible biomedical materials
2) Development and understanding of nanofibers and nanofiber based composites
3) Thin films
4) Development and characterization of the functional inorganic materials
5) Impacting perovskite material and devices
6)Teaching and learning

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

N/A

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received Book Chapter

TOTAL:

Patents Submitted

N/A

Patents Awarded

N/A

Awards

N/A

Graduate Students

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Post Doctorates

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Faculty Supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

N/A

Technology Transfer

N/A

Final Report

Acquisition of X-ray Photoelectron Spectroscopy System for Interdisciplinary Research & Education in Multi-scale Materials at The University of Texas – Pan American W911NF-14-1-0100

Dr. Waseem Haider

5/15/2015

K-Alpha X-ray Photoelectron Spectrometer (XPS) System ($369,035) with an extended warranty ($49,965) was purchased from Fisher Scientific Company, LLC. which has been or will be used in the following research projects:

1) Development of corrosion-resistant and biocompatible biomedical materials

   Surface chemistry of metallic (Titanium-based alloys, 316L Stainless Steel and Cobalt-Chromium alloys) and polymeric (Chitosan and Collagen) has been studied using x-ray photoelectron spectrometer. Initially, elemental surface composition has been obtained by XPS survey spectra. Prominent elements from XPS survey spectra has been selected for further analysis and high-resolution XPS spectra along with depth profiles have been obtained. A journal article was published and the support of US Army Research Office was acknowledged. Recently, two graduate students have completed their MS degrees and extensively used the XPS in their surface analyses. At the end of their studies, master's theses were written and the support of US Army Research Office was acknowledged.
2) Development and understanding of nanofibers and nanofiber based composites
   XPS is a great tool to study forcespun nanofiber composites for energy storage devices and also for ceramic nanofibers for aerospace and defense applications. Initially XPS has been used to characterize some nanostructures. More detailed analysis will be performed on forcespun nanofibers and nanofibers based composites. This research work is under progress
3) Thin films
   A professor and a graduate student from Electrical Engineering Department have studied semiconductor thin films on x-ray photoelectron spectrometer System. The chemistry of these layered semiconductor thin films has been investigated in detail. At the end of this study, master's thesis was written and the support of US Army Research Office was acknowledged.
4) Development and characterization of the functional inorganic materials
   The key research area in this research group is to develop functional inorganic materials with novel architectures and functional properties, in some cases heterogeneous nanomaterials with multi-nanocomponents, by various synthetic procedures. Our goal is to meet specific application needs by controllably synthesizing functional nanomaterials. Currently we are interested in transition metal oxides, including binary oxides and complex oxides (such as perovskites). Therefore, XPS will be very useful to determine the chemical and structural information of the synthesized functional materials along with other techniques. This research work is under progress.
5) Impacting perovskite material and devices
   X-ray photoelectron spectroscopy (XPS) will be used to significantly improve our fundamental understanding of these special, non-conventional, electric-field tunable materials that can result in further improvements in the temperature insensitivity of the dielectric properties of the material,

improvements in electric-field tunability, and decreased electrical losses, each of which improves device and system performance.

Teaching and learning: The XPS system is playing a significant role in active learning experiences. The hands on participation of the students in experimental research and class projects is allowing a better understanding of the practical challenges of science that are complex in lecture learning. Several existent courses such as MECE 6328 Spectroscopic Techniques, MECE 6327 Intermediate Nanotechnology, MECE 4333 Biomaterials, PHYS 3307 Introduction to Solid State Physics, and CHEM 6320 Advanced Instrumental Analysis are being or will benefit from XPS instrumentation since students are or will be allowed to complement their final projects with XPS work. Other courses such as Surface Characterization Techniques and Surface Science will be developed in future.

The XPS instrumentation is also strengthening MS programs in Mechanical Engineering, Electrical Engineering, Chemistry, Biology and Physics. The creation and strengthening of such programs will serve to empower South Texas where education improvement is of paramount importance.

Report Documentation Page (SF298)

1) Submissions or publications under ARO sponsorship during this reporting period. List the title of each and give the total number for each of the following categories:

   a) Papers published in peer-reviewed journals - 1
   R. Rokicki, W. Haider, S. Maffi, "Hemocompatibility Improvement of Chromium Bearing Bare Metal Stent Platform After Magnetoelectropolishing", Journal of Materials Engineering and Performance: Volume 24, Issue 1 (2015) pp. 345-352.

   b) Papers published in non-peer-reviewed journals- N/A

   c) Presentations
      i) Presentations at meetings, but not published in Conference Proceedings- N/A
      ii) Non-Peer-Reviewed Conference Proceeding publications (other than abstracts) –N/A
      iii) Peer-Reviewed Conference Proceeding publications (other than abstracts)-N/A
   d) Manuscripts – N/A
   e) Books – N/A
   f) Honor and Awards –N/A
   g) Title of Patents Disclosed during the reporting period – N/A
   h) Patents Awarded during the reporting period – N/A

2) Student/Supported Personnel Metrics for this Reporting Period (name, % supported, %Full Time Equivalent (FTE) support provided by this agreement, and total for each category): – N/A
   a) Graduate Students
   b) Post Doctorates
   c) Faculty
   d) Undergraduate Students
   e) Graduating Undergraduate Metrics (funded by this agreement and graduating during this reporting period):
      (i) Number who graduated during this period
      (ii) Number who graduated during this period with a degree in science, mathematics, engineering, or technology fields
      (iii) Number who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields
      (iv) Number who achieved a 3.5 GPA to 4.0 (4.0 max scale)
      (v) Number funded by a DoD funded Center of Excellence grant for Education, Research and Engineering
      (vi) Number who intend to work for the Department of

Defense

(vii) Number who will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields

f) Masters Degrees Awarded (Name of each, Total #)
g) Ph.D.s Awarded (Name of each, Total #)
h) Other Research staff (Name of each, FTE % Supported for each, Total % Supported)

3) "Technology transfer" (any specific interactions or developments which would constitute technology transfer of the research results). Examples include patents, initiation of a start-up company based on research results, interactions with industry/Army R&D Laboratories or transfer of information which might impact the development of products. – N/A

4) Scientific Progress and Accomplishments (description should include significant theoretical or experimental advances)– See above: page 1 & 2

5) "Copies of technical reports," which have not been previously submitted to the ARO, should be submitted concurrently with the Interim Progress Report. (See page 6 "Technical Reports" section for instructions.) However, do not delay submission while awaiting Reprints of publications. –N/A