

ME 495- Directed Research / BSc Research Thesis

2015-2016

Catalog Data	ME495 Directed Research / BSc Research Thesis (3-0-3) A well monitored and structured BSC Thesis/Directed Research Course for Active Research Projects-which could be taken only as a onetime Elective Special Topic. <u>It is only open to students having a GPA of 3 or above and consent of instructor is mandatory.</u> Faculty conducting the course must submit a formal well written program of research work and deliverables and grading policy in semester prior to enrollment for approval from department. Students can start working on the topics a head of time prior to formal enrollment as a course after its approval.
Textbook	Engineering Coatings – Design and Applications 2nd Edition, Stan Grainger and Jane Blunt, Abington Publishing, 1998
Instructor	Dr. Khaled Al-Athel
Goals	This course is intended to give the student basic knowledge on coatings, and a more in depth knowledge on analysis and assessment of steel-based coatings using various tests and experiments.
Outcomes	Specific Outcome of this Research Course The student is expected to learn how to: <ul style="list-style-type: none">- Perform and analyze SEM images (Top and cross-sectional)- Perform Pull-off adhesion tests- Perform microindentation tests- Perform scratch tests- Perform computational analysis (<u>If possible</u>)- Utilize all experimental data and results to provide an overall assessment of steel basic coatings on steel substrates General ME495 Outcomes (a) Imparting Research Skills and Tools – At the end of the course, the student will have learned how to do research work from literature review, to performing tests, and finally analyzing the data and discussing the outcomes. The student will have to work on various experimental tests and learn

how to perform them as well as how to extract the needed data from them.

- (b) **Imparting Skills to Professionally Document the Research Findings** - At the end of the course, the student is expected to submit a conference/journal paper summarizing the work he did in the course.

Research work **The student will start with literature review on various coating processes to understand the advantages of each process. Then, the student will work on 316 stainless steel coatings on stainless steel substrates with various coating thicknesses. A variety of tests will be performed to analyze the mechanical behavior of the coatings and assess its use in various applications. Experiments and tests will include SEM images, adhesion tests, microindentation, and scratch tests. Computational analysis will be included if possible depending on the students' knowledge on FEA.**

Evaluation

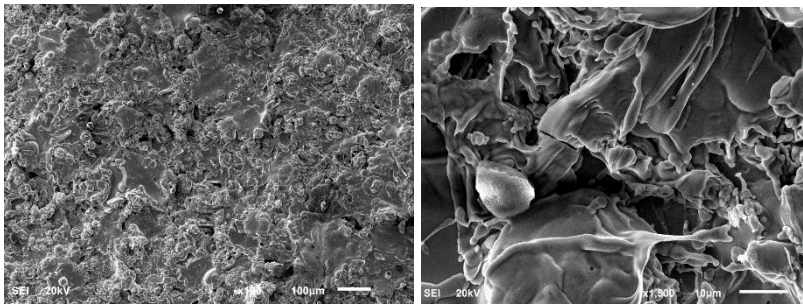
The student will meet with the course Instructor on a weekly basis and submit biweekly reports to the Instructor. A final report will be prepared in form of formal research paper ready for submission. The student will also make a presentation at the end of the semester.

The presentation will be evaluated by the Instructor and a panel of Mechanical Engineering faculty members. The panel of faculty, including the course instructor, will evaluate the report and the presentation.

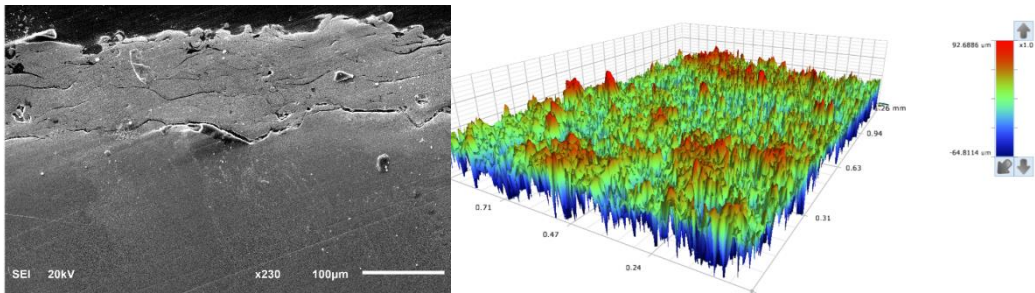
Grading

Weekly meetings	20%
Progress Reports	30%
Final Report	25% (in Research Paper Form Ready for Submission)
Oral presentation	15% (panel)
Poster Presentation	10%

Sample Results



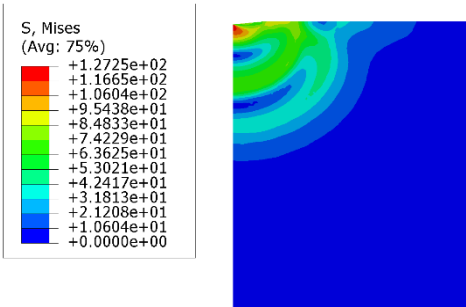
Sample SEM images for Cu coating



Cross-sectional SEM image of Cu Coating and Roughness Profile



Pull-off adhesion test



Computational Simulation of Microindentation test