

**ABET  
Self-Study Report**

**BS in Metallurgical Engineering Degree**

**South Dakota School of Mines and Technology  
Rapid City, SD**

**June 20, 2016**

**CONFIDENTIAL**

The information supplied in this Self-Study Report is for the confidential use of ABET and its authorized agents, and will not be disclosed without authorization of the institution concerned, except for summary data not identifiable to a specific institution.

(Intentionally blank)

## TABLE OF CONTENTS

Background Information.....	i
General Criteria	
Criterion 1 - Students.....	1-1
Criterion 2 - Program Educational Objectives.....	2-1
Criterion 3 - Student Outcomes .....	3-1
Criterion 4 - Continuous Improvement.....	4-1
Criterion 5 - Curriculum .....	5-1
Criterion 6 - Faculty.....	6-1
Criterion 7 - Facilities.....	7-1
Criterion 8 - Institutional Support.....	8-1
Program Criteria	9-1
Appendices	
A – Course Syllabi.....	A-1
B – Faculty Vitae .....	B-1
C – Equipment .....	C-1
D – Institutional Summary.....	D-1
E –Assessment Documents.....	E-1
F – Glossary .....	F-1
Signature Attesting To Compliance.....	G-1

(Intentionally blank)

Program Self-Study Report for  
ASAC of ABET Accreditation  
Metallurgical Engineering  
Bachelor of Science Degree  
South Dakota School of Mines and Technology

## **BACKGROUND INFORMATION**

### **A. Contact information**

Dr. Michael West, Professor and Head  
Department of Materials and Metallurgical Engineering  
Mineral Industries Building  
South Dakota School of Mines and Technology  
501 E Saint Joseph Street  
Rapid City, SD 57701

Ph: 605 394-1283  
FAX: 605 394-3369

[michael.west@sdsmt.edu](mailto:michael.west@sdsmt.edu)

### **B. Program history**

The following is a summary of program and major changes occurring since the last general review.

The metallurgical engineering program began with the establishment of then Dakota School of Mines in 1885. The state constitution specified, and continues to require, that mining and metallurgy be taught in at least one state institution.

Since 1972 the Department of Metallurgical Engineering faculty has consisted of five full-time, tenure-track faculty members, one of whom served as a chair or head. Undergraduate student numbers ranged from 40 to 70. Since the previous 2010 ABET visit, the number of both faculty and students have increased notably as a university strategic initiative to move from approximately 2000 undergraduate and 200 graduate students to 3000 undergraduate and 500 graduate students. In 2012, the university moved from a six-year rotating department chair system of departmental administration to a system of permanent department heads. In 2014 Dr. Kellar, the previous chair/head returned to full time professorship as Dr. West accepted the department head responsibilities.

At the time of the previous 2010 ABET visit, the departmental faculty consisted of five full-time tenured or tenure-track professors (Howard, Kellar, Cross, Medlin, West) with 75 years of departmental program experience. Medlin has since taken another position and Howard has retired but is actively engaged in the department and program in a part time position as Professor Emeritus and Senior Lecturer. Three new tenure-track professors have joined the department since the last review in 2010 and are actively engaged in the program (Crawford, Jasthi, and Safarzadeh). The department has been fortunate in filling these vacated positions with highly-qualified professors via open and nationally advertised search processes. Dr. Grant Crawford received his doctorate from the Arizona State University in 2008 and has

three years of experience with Intel. Dr. Sadegh Safarzadeh recently received his doctorate from the University of Utah and has four and a half years of employment experience in the extractive metallurgy of Pb and Zn while Dr Bharat Jasthi has three years of experience in advanced materials processing and received his doctorate from the South Dakota School of Mines and Technology (SDSM&T).

Additionally, the department enjoys the shared appointments of two full-time faculty members secured through a nationwide search process: 1) Dr. David Salem, Director of the Composite and Polymer Engineering (CAPE) Laboratory and Professor of Metallurgical Engineering and Chemical and Biological Engineering (CBE) and 2) Dr. Christian Widener, Director of the Arbogast Advanced Manufacturing Center and Associate Professor of Mechanical Engineering and Metallurgical Engineering. Dr. Salem completed his PhD at the University of Manchester, UK and Dr. Widener completed his PhD at Wichita State University.

The biggest change in the program's curriculum has been the regental-mandated reduction in program credit hours from 136 to 130. On July 1, 2012 the program reduced the total number of required hours for degree from 136 to 130 by mandate from the South Dakota Board of Regents Policy 2:29, Sec 1. C. 1 (<https://www.sdbor.edu/policy/documents/2-29.pdf>). To achieve this reduction, the program faculty agreed to implement six, one-credit hour reductions: 1) eliminate a physics II laboratory, 2) reduce humanities and social science electives from 16 to 15 credits, 3) eliminate one of two credits of physical education, 4) eliminate a freshmen orientation type course MET 110, and 6) reduce the hours of required free elective from 6 to 5. Freshman students are encouraged to enroll and attend the introductory orientation style course MET 110, but it is not required.

Dr. Crawford has introduced Forensic Engineering (MET 450/550), shares in teaching the program's physical metallurgy courses (MET 330/330L, MET 332), mechanical metallurgy (MET 440/440L), and has focused heavily on improving the capstone design experience (MET 351, 352, 464, and 465) for our students. Dr. Safarzadeh has assumed teaching duties for most of the courses Dr. Howard taught including Metallurgical Thermodynamics (MET 320), Transport Phenomena in Metallurgical Engineering (MET 422), and High Temperature Extraction, Concentration, and Recycling (MET 321/321L)

Dr. Jasthi is responsible for Dr. Howard's previously-taught Steelmaking course (MET 426/526), offers Corrosion and Oxidation (MET 445/545), and shares teaching of the populous sections of Properties of Materials Laboratory (MET 231L). Elective course offerings have remained unchanged since 2010 except for the addition of Forensic Engineering (MET 450/550).

The second major change since the last review has been the extensive revamping of the operation of the combined junior and senior design course sequence. In 2010 the program's juniors and seniors were very engaged in the Samurai Sword Project, which produced a Samurai sword starting with local iron ores. This project, which is ongoing, integrated all aspects of metallurgical engineering, and drew heavily upon the program core curriculum. In addition, new design model cohorts junior (MET 351/352) and senior (MET 464/465) students on design teams and involved all program faculty. In 2008-9 all juniors and seniors were assigned to one of four Samurai Sword design teams: pelletizing, reduction, forging, or quenching. In 2011-12 the program having largely accomplished the Samurai project, took a new direction under the direction of Dr. Crawford in which teams of three to four students undertook a project under the mentorship of one program professor. The projects are intentionally trending towards industrially partnership and increased funding. The rather unstructured previous format is now highly structured with frequently reports and much-increased attention to project

planning and management. In 2014-15 and 2015-16, there have been eight teams of four students, each with a program adviser (West, Crawford, Keller, Cross, Jasthi, Safarzadeh, Howard, and Widener).

In 2012 the Department of Metallurgical Engineering was authorized to hire Ms. Jessica Zacher as a full time senior secretary, which is a substantial improvement over the half time arrangement the department operated under during the 2010 ABET visit. This has provided for superior secretarial services, office management, and accounting focused more clearly on the department's programs and operations, which include instruction, award financial tracking, travel, scheduling, and office security.

### **C. Options**

The BS in Metallurgical Engineering degree program has no options or tracks but the department offers a minor in *Materials Science – Metals* for other degree programs. This minor is composed of courses within the metallurgical engineering degree program so the teaching of no additional courses is required. The minor has been popular among BS Mechanical Engineering students with between 5-10 students enrolled in the minor since 2009. The BS in Metallurgical Engineering program has 17 credit hours of elective courses: five free electives; six science electives; and six directed technical electives. The department maintains and publishes a list of *BS Met. Eng. Authorized Science Courses* that qualify as science electives. A suite of 400-level MET courses are available for selection as *Directed Met Electives*, or students can take, upon approval by the head, an engineering course outside of the program if it has a Metallurgical Engineering-related component. Students have considerable freedom in selecting free electives, but program faculty advisors monitor student selections to assure substantial course selections continue.

### **D. Program delivery modes**

The program mode of the BS Metallurgical Engineering program is a 100 percent day-time program. Cooperative education courses (CP 297/397/497) courses generally involve students completing an intern/coop experience with an off-campus industrial firm. There is no difference in this program from other engineering programs on campus.

### **E. Program locations**

The only location where the program is delivered is on the SDSM&T campus in Rapid City, SD. However, South Dakota has an integrated university system with common course numberings, so students may take courses of the same prefix and number designation for credit at any of the other five regional system universities. There are no such courses in the BS Metallurgical Engineering (MET) program, but there are many in the sciences, mathematics, and humanities and social sciences. These courses are accepted for credit without transfer scrutiny.

### **F. Public disclosure**

The Program Education Objectives are posted at the following locations:

- Department of Materials and Metallurgical Engineering bulletin board on the first floor of the Mineral Industries Building.
- <http://www.sdsmt.edu/Academics/Departments/Materials-and-Metallurgical-Engineering/Accreditation---Assessment/>
- [http://ecatalog.sdsmt.edu/preview\\_program.php?catoid=14&poid=1132&returnto=2608](http://ecatalog.sdsmt.edu/preview_program.php?catoid=14&poid=1132&returnto=2608)

The Student Outcomes are posted on the following locations:

- Department of Materials and Metallurgical Engineering bulletin board on the first floor of the Mineral Industries Building.

- <http://www.sdsmt.edu/Academics/Departments/Materials-and-Metallurgical-Engineering/Accreditation---Assessment/>

Annual student enrollment and graduation data is posted or made accessible to the public at the following location:

- <http://www.sdsmt.edu/Campus-Life/Career-Center/Career-Center-Placement/>
- Department of Materials and Metallurgical Engineering bulletin board on the first floor of the Mineral Industries Building.

**G. Deficiencies, weaknesses or concerns from previous evaluation(s) and the actions taken to address them**

There were no Deficiencies, Weaknesses, or Concerns cited in the most recent (2010) ABET Final Statement. Therefore, no specific actions to address were required.