**MTGN314+L: Processing and Properties of Ceramics**

**A New Course in the Revised MME Curriculum**

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**INTENDED OUTCOMES**

- **Week 1:**
  - **Lecture:** Activate knowledge from 202, 211, 272, 251, 281
  - **Lab:** (Re)introduce labs & equipment

- **Week 2:**
  - **Lab:** Particle size and distribution, mixing, milling, rheology labs

- **Week 3:**
  - **Lecture:** Powders and colloids
  - **Lab:** Forming methods: extrusion, tape casting, slip casting, dry pressing, melt forming, 3D printing

- **Week 4:**
  - **Lab:** Phase diagrams

- **Week 5:**
  - **Lecture:** Structures and defects
  - **Lab:** Sintering and density labs

- **Week 6:**
  - **Lecture:** Properties (primarily electrical and mechanical)
  - **Lab:** Electrical and mechanical properties labs

- **Week 15:**
  - **Lab:** Report out group projects

**Broader Benefits of MTGN314+L to MME**

- Lays groundwork for lab report writing
- Exposure to ceramics and powder-based processing in Junior year broadens student perspectives and reinforces fundamental materials concepts
- Multi-week lab modules with self-directed access to equipment (after training) primes students for greater independence in courses and research opportunities

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**ASSESSMENT**

**Primary targets:** students, instructor, curriculum

**Formative assessments:**
- Explicit and iterative discussion of levels of cognition and mastery
- Peer and instructor feedback in labs
- Brief pre-tests and self-evaluations
- Many small group activities with peer feedback
- Weekly check-in questions to instructor

**Summative assessments:**
- Four lab reports, one for each multi-week lab module; work in groups, submit individually
- Two take-home exams
- Semester-long team project
- Pre-/post-concept inventory
- Course evaluations

**Course assessments:**
- (Relative) enrollment in ceramic electives
- Responses during exit interviews
- Employer feedback
- Scores on senior diagnostic exams
- Co-op, study abroad, etc. numbers
- 8 semester graduate rates

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**CONTEXT:** Revised MME Curriculum

- Move CHGN209 to restricted tech elective
- Add MTGN314+L to address student feedback and faculty expertise
- Shift four courses from Junior to Sophomore year
- Shift two courses from Senior to Junior year
- Expand senior design to two semesters
- Breaking up the lockstep sequence of the previous curriculum provides huge gains in flexibility for coop, study abroad, transfer, etc.

**OUTCOMES**

- **Weekly check:**
  - Scores on senior diagnostic exams

- **Scores on senior diagnostic exams** describe and apply direct

- **Many small group activities with peer**

- **Explicit and iterative discussion of levels**

- **Four lab reports, one for each multi**

- **Report out group projects**

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**NEW COURSE: MTGN314+L (baking π)**

- **MTGN412** intro elective
- **MTGN414** intro elective
- **MTGN314+L** required
- **MTGN414** advanced elective

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**Revised MME Curriculum and Materials Engineering**

Geoff Brennecka received BS and MS degrees in Ceramic Engineering from the University of Missouri-Rolla (now Missouri S&T), a PhD in Materials Science and Engineering from the University of Illinois, and spent 8 years as technical staff at Sandia National Labs before arriving at Mines in 2014. He was instrumental in the recent MME curriculum revision and is heavily involved in both the MME undergraduate and Materials Science graduate programs. Geoff is very active in IEEE and the American Ceramic Society, of which he is a Fellow.