

Let's talk about Materials Science!

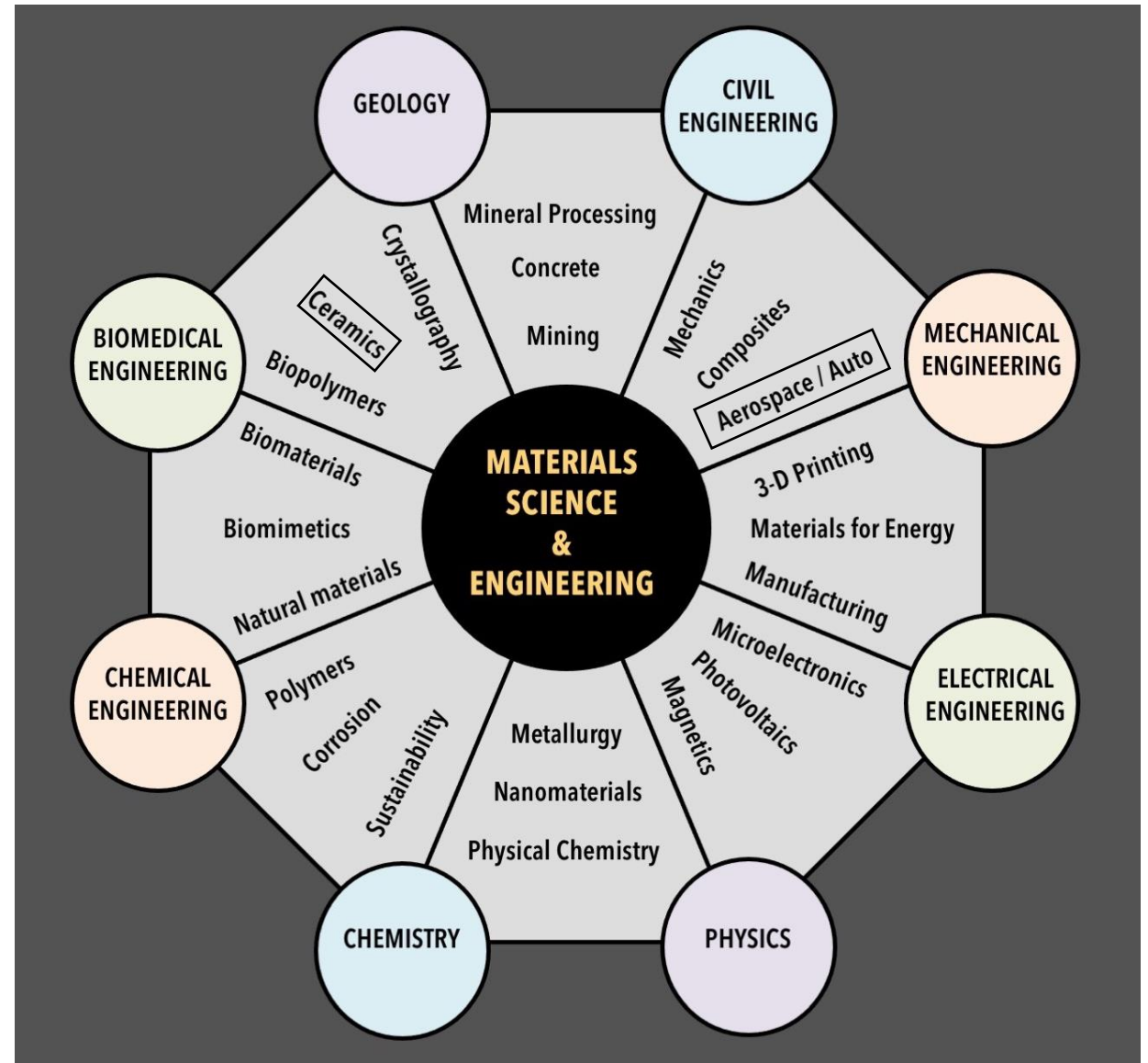
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What is Materials Science?

- Interdisciplinary field focused on the discovery, development, and implementation of novel materials to solve real-world challenges (e.g. faster and more fuel-efficient vehicles, better electronics, safer biomedical supplies, etc.)
- It's a rapidly growing field that needs new, motivated scientists to lead the charge in exploring new concepts like machine learning, artificial intelligence, and biomimetic devices

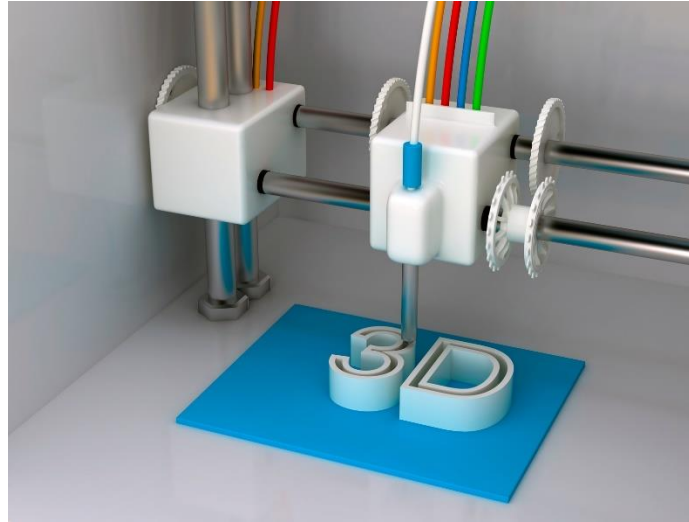


What materials do materials scientists work on?

Metals



Polymers



Ceramics



All three classes of materials have unique characteristics!

Okay what *is* ceramics engineering?

Basic Definition: Ceramic engineering is the practice of creating inorganic, non-metallic materials.

- It's a lot of chemistry!
- It's A little bit a physics
- It's a lot of working with your hands in a lab!
- It involves the study of how particles interact, form, and behave under applied stress and temperature.
- You get to work with a lot of the elements on the periodic table



1 IA H Hydrogen 1.008	2 IIA He Helium 4.002602																	18 VIIIA
3 Li Lithium 6.94	4 Be Beryllium 9.0121831											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998403163	10 Ne Neon 20.1797	
11 Na Sodium 22.98976928	12 Mg Magnesium 24.305											13 Al Aluminum 26.9815385	14 Si Silicon 28.0855	15 P Phosphorus 30.973761998	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.948	
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955908	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938044	26 Fe Iron 55.845	27 Co Cobalt 58.933194	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.921595	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.848	
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90584	40 Zr Zirconium 91.224	41 Nb Niobium 92.90637	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.603	53 I Iodine 126.90447	54 Xe Xenon 131.293	
55 Cs Caesium 132.90545196	56 Ba Barium 137.327	57 - 71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.227	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.592	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	
67 Fr Francium (223)	68 Ra Radium (226)	69 - 103 Actinoids	104 Rf Rutherfordium (261)	105 Db Dubnium (268)	106 Sg Seaborgium (269)	107 Bh Bohrium (270)	108 Hs Hassium (285)	109 Mt Meitnerium (278)	110 Ds Darmstadtium (285)	111 Rg Roentgenium (282)	112 Cn Copernicium (285)	113 Nh Nihonium (286)	114 Fl Flerovium (289)	115 Mc Moscovium (289)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)	

57 La Lanthanum 138.90547	58 Ce Cerium 140.19	59 Pr Praseodymium 140.90766	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93033	68 Er Erbium 167.259	69 Tm Thulium 168.93422	70 Yb Ytterbium 173.045	71 Lu Lutetium 174.9668
89 Ac Actinium (227)	90 Th Thorium 232.0377	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (260)

Many opportunities for coding, modeling, and robotics

- The field of ceramics engineering needs more experts on casting, glazing, and additive manufacturing to create novel, complex parts!



Additive manufacturing is the process of printing multiple, stacked layers of material to create finished products with complex geometries. The parts can be used for aerospace, automotive, and industrial applications!

Are you interested in health care?

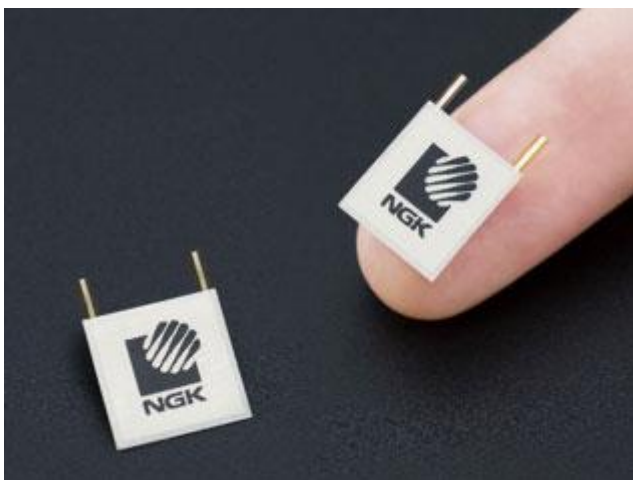


Artificial femur with ball-and-socket joint made of ceramic.



CeramTec is a leading designer and manufacturer of next-generation biomedical devices!

Are you interested in renewable energy?



Solid-state, ceramic, rechargeable batteries are the future of clean energy and electric vehicles.



Many solar panels require advanced ceramic materials for operation.

My background

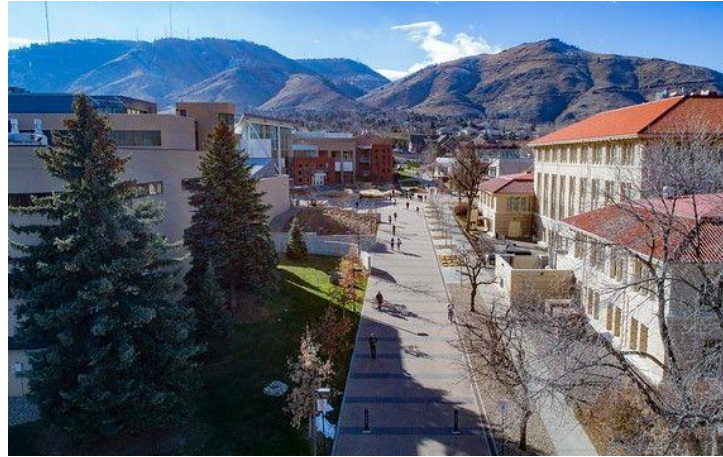
Lansing High School (2010-2014)



- LHS Soccer
- Sporting Kansas City Academy
- National Honor Society Secretary
- Kaw Valley Math Competition

Stay involved!

Colorado School of Mines (2014-2018)



- CSM Men's Varsity Soccer
- Helped found undergraduate research journal
- On-campus lab research job
- On-campus materials science societies/organizations

Stay involved!

University of California, Santa Barbara (2018-2023)



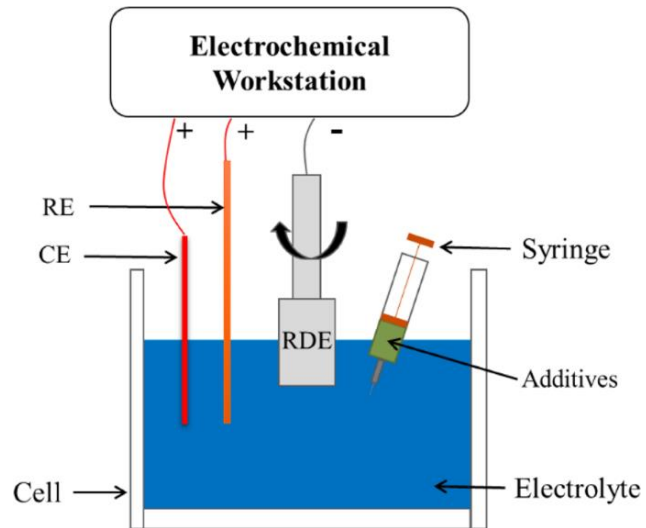
- 3rd-year PhD candidate in the Materials Department
- Involved in the American Ceramic Society (ACerS)

Stay involved!

My internships showed me how diverse Materials Science is

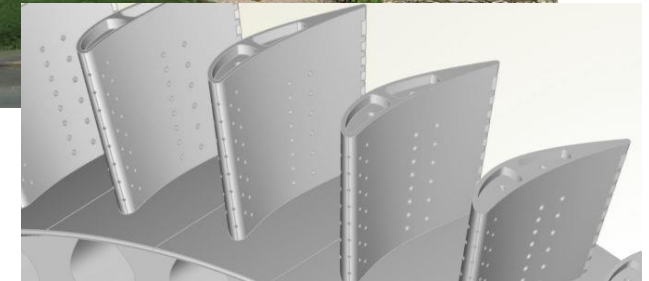


Gaithersburg, MD,
Summer 2017



www.sciencemag.org

Cleveland Ohio, Summer 2018

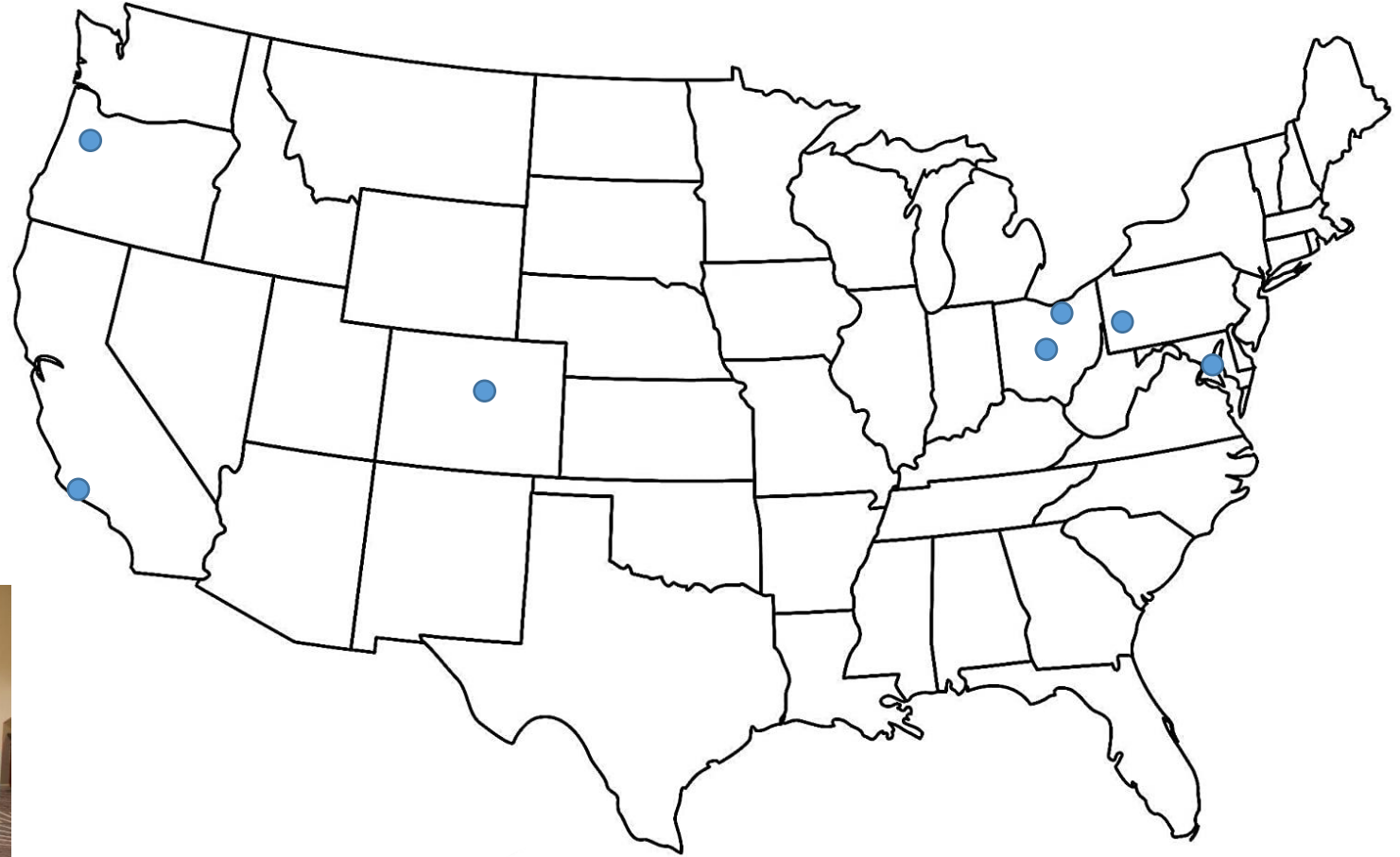


nasa.gov

I got to travel too!



- Conferences in OH, PA, OR, etc.
- Internships in OH, MD
- School in CO, CA
- Research presentation in Japan!



President's Council of Student Advisors (PCSA), 2019

You can be compensated well!

Typical salaries:

- Summer internships (with room-and-board covered) \$13-25/h
- Engineer with B.S. degree: \$50K-90K/y
- Engineer with M.S. degree \$80K-110K+/y
- Assistant professor: ~\$100K+/y
- Tenured professor \$150-400K+/y
- Project manager or company leader: \$200K-400K+/y
- Senior research scientist at a national lab: \$100K-400K+/y

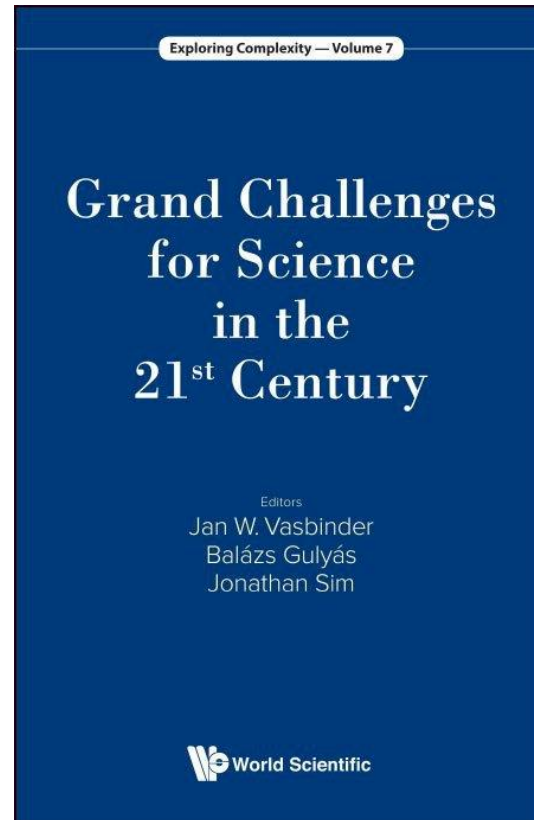
Other benefits:

- Travel! Engineering is a great way to see the world.
- Collaboration! A great way to meet new people at conferences.
- Personal growth! Fields are rapidly developing, requiring hardworking and dedicated scientists.

Why are materials scientists and engineers in such high demand?

- Most of the world's big problems require materials science to solve
- There are more jobs than employees available for hire

Power and Energy
Robotics
Space Exploration
Biomedical devices
Artificial Intelligence
The list goes on!



Find a similar resource and see what interests you!

General tips for college (even if you don't go into Materials Science)

- Live in a freshman dorm your freshman year
 - Everyone will be looking to make friends! Much harder to make friends off campus.
- Do all of the orientation activities!
 - Events like these are a great way to meet people you'd otherwise never see.
- Join club organizations and societies, and give back to your community
 - This is a great way to give back while at the same time meeting like-minded people.
- You might regret the things you didn't do
 - You never know who you might meet when you put yourself out there.
- Find a mentor
 - Having a support system is critical to enjoying your time at school and navigating the challenges that will come your way.
- Most importantly, work hard and **have fun!**