PORT FOLIO

Hannah Skye Smith

Morphological Study

9th and 9th, Salt Lake City

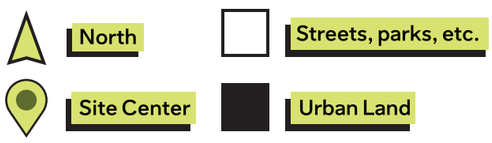
9th and 9th is a quaint neighborhood in Salt Lake City named for its location at the intersection of 900 East and 900 South. The Mormon pioneer-settled city established a gridded urban tissue pattern, taking inspiration from Joseph Smith's utopian plan, the 'Plat of Zion'. This plan consisted of ten-acre city blocks and notably wide roads. South of 900 South, the grid shifts in scale to accommodate outlots dubbed the "Big Fields," twenty-acre agricultural plots. Eclectic retail, dining, and public art line the 900 South corridor, attracting a wide variety of interests. Recently, the 9-Line project saw the addition of divided bicycle and pedestrian paths and additional bus stop infrastructure along 900 South.

Paseo del Prado, Havana

Since the arrival of Spanish colonizers, the site of Paseo del Prado has undergone significant evolution. Initially the Rincon refuse dump, it later became Alameda de Paula, a dirt road lined with poplar trees and seating. Eventually tile paving, stone benches, marble columns, and lampposts were added. In the early 20th century Havana saw new mansions, luxury hotels, nightclubs, and casinos during a period of affluence, drawing crowds of tourists and immigrants. In 1925, Jean-Claude Nicolas Forestier redesigned Paseo del Prado as a European-style boulevard with bronze lions, marble benches, stone walls, and captivating arcades. European style buildings lined the boulevard, and Havana was dubbed the "Paris of the Antilles."

9th and 9th in Salt Lake City's East Liberty neighborhood, with Liberty Park to the southwest. 1 sq mile

Paseo del Prado, Havana on the northern coast of the Havana Bay. Pictured in the northeast corner is a portion of eastern Havana, across the Port from the Old City. 1 sq mile



Scale of Streets

Scaled comparison of right-of-way -designations between 9th and 9th and Paseo del Prado.

Comparison

The scale of 9th and 9th is illustrated here with respect to the size of an average person. Each side of 9th and 9th is separated by a significant distance, which impacts the cohesion between either side of 900 South. Paseo del Prado is a centralized pathway, which creates a sense of physical safety from traffic and allows people to travel freely along the promenade to hotels, bars, and cafes without exposure to automobile traffic.

While Salt Lake City's sprawled urban tissue was developed before the ubiquity of the car, little change was required to accommodate robust vehicle transportation. 9th and 9th's narrow walking paths are located on either side of the wide roadway, which signals to visitors that cars are the priority. In contrast, Paseo Prado boasts a large central pedestrian path and wide pathways under building arcades, with modest vehicle roadways between.

Quick Facts	9th and 9th	Prado
Cars per 100 people	**815**	**21**
Vehicle road width	**56 feet**	**18 feet**
Walking path width	**16 feet**	**58 feet**
Central walking path?	**No**	**Yes**

Modeling Manufacturing: Sustainable Instrumentation for Clean Energy Systems

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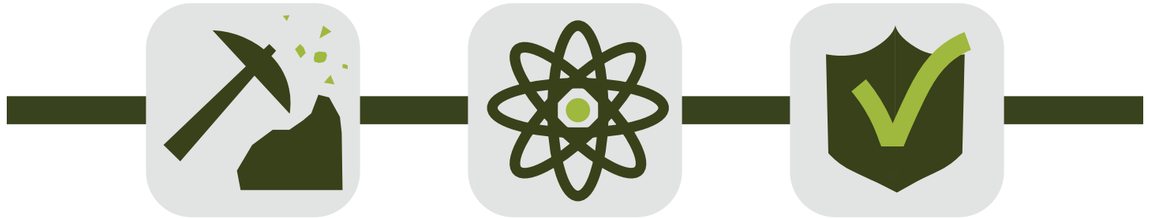
Purpose of Research



Reduce demand for rare earth metals

Increase availability of clean power

Maintain security of power plants

Background

Nuclear power produces billions of kilowatt hours of electricity that people worldwide rely on. Because of the nature of nuclear power, careful instrumentation is required to mitigate potential issues in nuclear reactors. Among these are temperature sensors called thermocouples that are placed inside a reactor, or "in-pile," to provide real-time temperature data. Traditional thermocouples have a short lifespan and degrade at temperatures above 1100 degrees Celsius. Previous studies from the Idaho National Laboratory indicate that thermocouples made from an alloy of molybdenum and niobium have the capacity to resist temperatures of up to 1500 degrees Celsius for up to 4000 hours. These are called high temperature irradiation resistant thermocouples (HTIR-TC).

Environmental Impact

Thermocouples are typically made from rare earth metals that require intensive mining operations, which are environmentally destructive and often employ exploitative labor practices. The increased lifespan of the HTIR-TC reduces demand for rare earth metals. Advanced manufacturing is a viable fabrication option that uses additive methods similar to 3D printing without wasting rare earth metals, further increasing the sustainability of the supply chain.

Nanoparticle Interactions

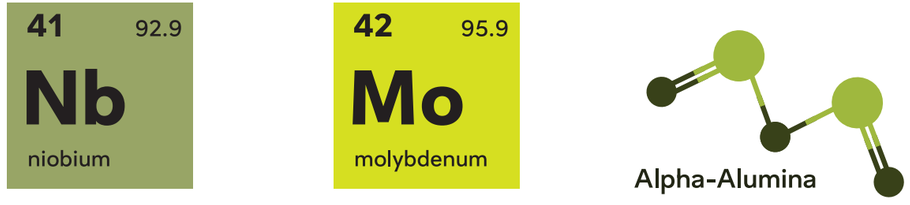


Figure A

Molybdenum nanoparticles on alpha-alumina surface

Figure B

Niobium nanoparticles on alpha-alumina surface

Aerosol-jet printers condense metal particles to “print” them on a substrate. This study examines the interactions between Mo and Ni nanoparticles with an alpha-alumina substrate. Understanding how Mo and Nb nanoparticles interact with the alumina surface is instrumental to optimizing the advanced manufacturing. process and ensuring instrumentation sustainability.

Note

Simulations of nanoparticle interactions require supercomputing that takes up to days to complete. Computation is ongoing. Results will guide nanoparticle sizes for future experimental printing of the alloy.

Density functional theory calculations

This study employs density functional theory, a method for modeling quantum mechanics. Density functional theory was used to calculate the electronic band structures for several materials (Figures C & D) . These were compared to previous literature, confirming the reliability of simulations.

Figure C

Copper face-centered cubic

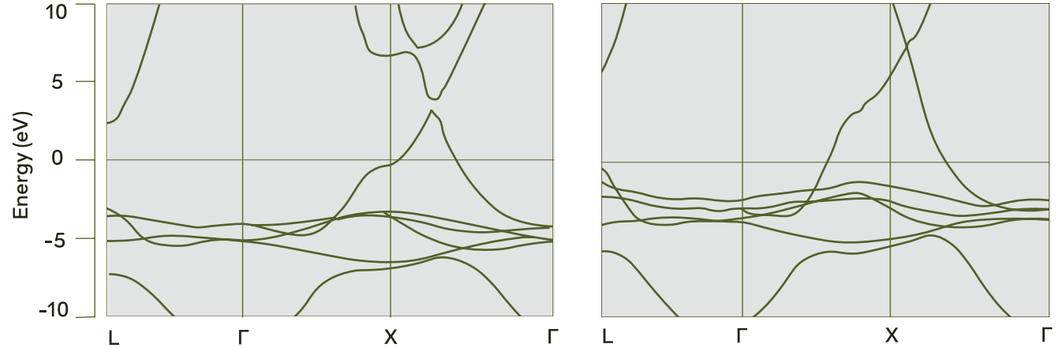
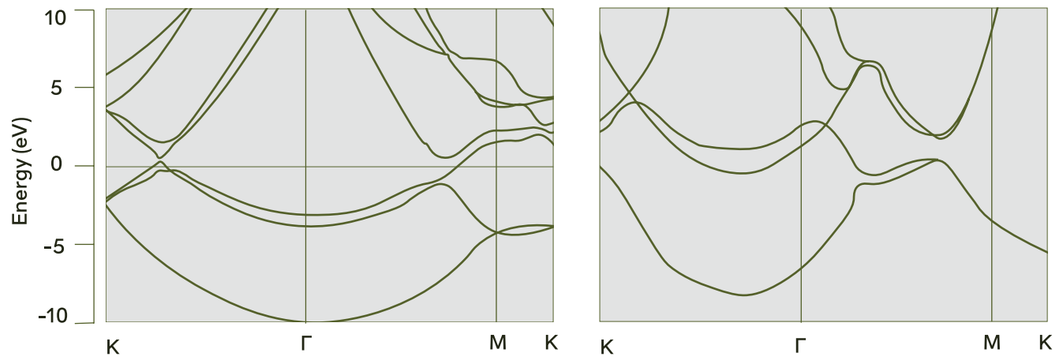


Figure D

Magnesium hexagonal close-packed



(Figures C & D) Electronic band structures produced using density functional theory with VASP (right) and electronic band structures from existing literature (right).