



Department of Materials Science and Engineering



ELECTROCRAMICS LABORATORY

*Analytical and non-analytical
instruments*

Shiraz University





Department of Materials Science and Engineering

NON- ANALYTICAL INSTRUMENTS



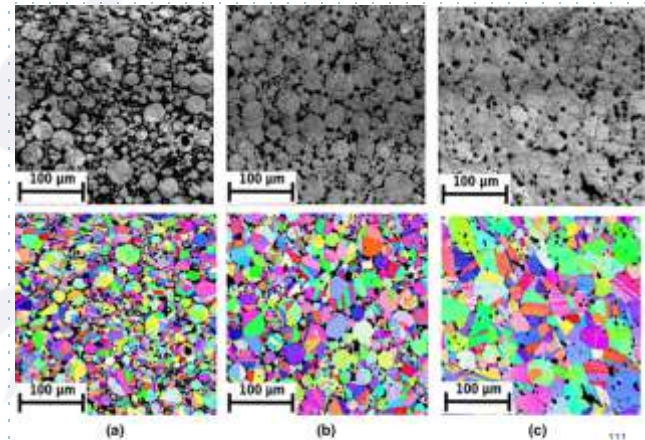
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Electric resistance furnace

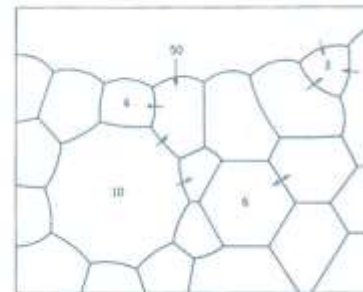
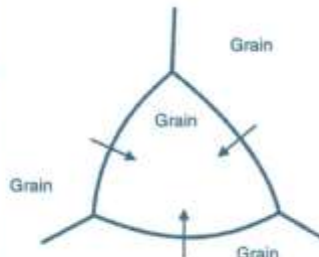
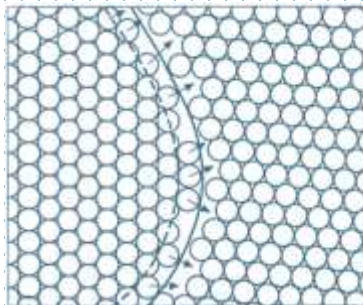
Introduction

Electric resistance furnaces are of the indirect type by which electric energy is converted into heat as a current flows through the heating elements. These furnaces can be used for heat treatment, sintering, calcination, annealing, and etc. Resistance furnaces provide higher temperatures, more uniform temperature distribution, ease of automation and temperature control. Additionally these furnaces are more safe than many other types of furnaces.



Compaction direction is normal to sheet surface

Microstructure and texture evolution of a powder specimen subjected to sintering in different temperatures



Schematic presentation of microstructural evolution during sintering

Device: Resistance furnace

Manufacturer: *AZAR/NFE1700R-3DH*



Technical specification

Maximum temperature	1640 °C
Capacity	3 L

Device: Resistance furnace

Manufacturer: *EXCITON/Ex-1200-2L*



Technical specification

Maximum temperature	1000 °C
Capacity	1 L

Device: Resistance furnace

Manufacturer: *EXCITON/EX-1200-4L*



Technical specification

Maximum temperature	1000 °C
Capacity	2 L

Device: Resistance furnace

Manufacturer: *MAHAR/PCD33A*



Technical specification

Maximum temperature	1100 °C
Capacity	8 L

Device: Resistance furnace

Manufacturer: MAHAR/PCD33A



Technical specification

Maximum temperature **1000 °C**

Capacity **8 L**

* **Equipped with NP200 controller**

Device: Resistance furnace

Manufacturer: MAHAR/PCD33A



Technical specification

Maximum temperature **1460 °C**

Capacity **8 L**

* **Equipped with NP200 controller**

Device: Resistance furnace

Manufacturer: MAHAR/PCD33A



Technical specification

Maximum temperature 1360 °C

Capacity 8 L

* Equipped with NP200 controller

Device: Resistance furnace

Manufacturer: ATRA/AFE1400L-3DH



Technical specification

Maximum temperature 1360 °C

Capacity 3 L

Device: Resistance furnace

Manufacturer: *Azar*



Technical specification

Maximum temperature	1150 °C
Capacity	1 L
* Equipped with NP200 controller	



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Device: Horizontal tube furnace

Manufacturer: *ATRA/ATE-1100L*



Technical specification

Maximum temperature	900 °C
Heating tube dimensions	length: 30 cm, Diameter: 5 cm

- * Providing the capability to use inert gas
- * PID control to program the temperature regime



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Device: Cut off machine-precision cutter

Manufacturer: *SANAT CERAM CO.*



This lab is equipped with a high precision **cut off machine** for fine cutting of specimens. Cut off machines are used for cutting raw materials into their specified dimensions. In contrast to the typical saws such as the smaller portable ones, the cut off machine is an industrial-strength saw that is used for heavy and repeated use. Fine cutting of the ceramic specimens



Technical specification

- * Providing rotation speed up to 50 rpm
- * Increasing the cutting speed during the cutting process



Device: Glovebox

Manufacturer: *BACKER/VBOX2-HIM*



A laboratory **glove box** is a sealed enclosure designed to create and maintain an environment where the air inside is filtered and replaced with sterile air. This allows for sensitive operations to be carried out without contamination.

Technical specification

Vacuum of the main container	-0.999 bar
Vacuum of the side chamber	-0.999999 bar
Glove size	2 gloves, 60 cm



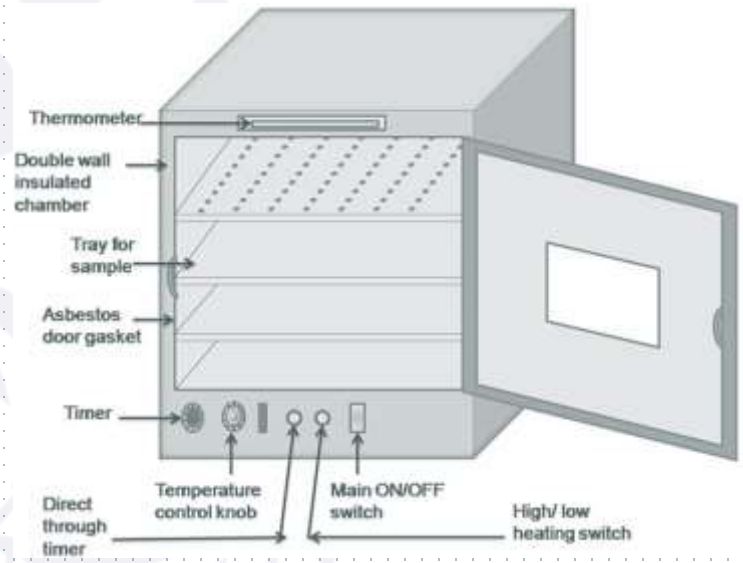
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Device: Laboratory oven

Introduction

Laboratory ovens are standard equipment found in most clinical, forensic, electronics, material processing, and, research laboratories. Laboratory ovens provide uniform temperature and precise temperature control for annealing, heating, baking, drying, curing, evaporating, sterilizing and other industrial laboratory functions. This lab is equipped with 3 ovens with different capabilities and special features which will be presented.



Schematic presentation of a laboratory oven

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Device: Regular laboratory oven

Manufacturer: *MEMMERT/800-100*



Technical specification

Maximum temperature	250 °C
Temperature accuracy	±0.5 °C
* Programmable	
* Equipped with a fan	

Device: Digital laboratory oven

Manufacturer: *LABCON*



Technical specification

Maximum temperature	250 °C
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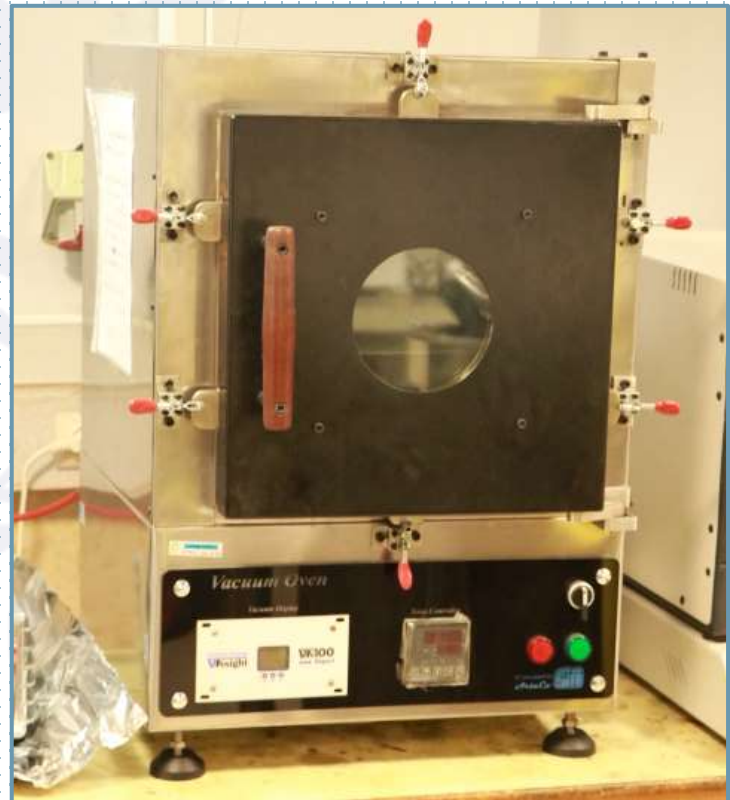
Device: Vacuum laboratory oven

Manufacturer: *ELM GOSTARAN SANATARIYA*



Technical specification

Maximum temperature	300 °C
Capacity	40 L
* Programmable	



Device: Autoclave

Manufacturer: NAZERKARAN INSPECTION & ENGINEERING CO.



Autoclaves are pressure vessels used to process parts and materials which require exposure to elevated pressure and temperature such as cure polymeric coatings and layers, vulcanize rubber, and hydrothermal synthesis.

Technical specification

Designed temperature	200 °C
Working pressure	21 atm
Capacity	9 L



Device: Ultrasonic homogenizer

Manufacturer: *AORAN/FS600N*



Technical specification

Output power	600 w (0%-100% continuous adjustable)
Frequency	20 kHz
Capacity	20-500 ml
Total working timer	1s – 99 hours with pause function



Device: Ultrasonic cleaner

Manufacturer: *POWER SONIC/LUC-410*



Technical specification

Time Range	1~99 min (Digital)
Temperature range	Ambient~70°C (Digital)
Frequency	40 kHz
Tank capacity	10.7 L

Device: Centrifuge

Manufacturer: *POLE IDEAL TAJHIZ CO./UNIVERSAL 320*



Technical specification

Maximum rotational speed	12000 rpm
Capacity	4 × 100
Maximum relative centrifugal force	21382
Time range	1 – 100min
* Equipped with impulse system for short term applications	

Device: Centrifuge

Manufacturer: *HETTICH/ROTOFIX 32A*



Technical specification

Maximum rotational speed	4000 rpm
Capacity	4 × 100 ml or 15 × 32 ml
Maximum relative centrifugal force	4226
Time range	1s – 99 min
* Equipped with impulse system for short term applications	

Device: Cold incubator

Manufacturer: PARSIAN TEB



Technical specification

Minimum temperature

-6°C



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ANALYTICAL INSTRUMENTS



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Device: Precision lab. balance

Manufacturer: *KERN/ALS 220-4*



Technical specification

Resolution	0.0001 g
Maximum weight	220 g

Device: Precision lab. balance

Manufacturer: *A & D/GF-300*



Technical specification

Resolution	0.01 g
Maximum weight	300 g



Device: LCR meter

Manufacturer: ARMA



Technical specification

- * Measurement of inductance
- * Measurement of capacitance
- * Measurement of resistance



Device: pH meter

Manufacturer: METROHM/827



Technical specification

Measuring range	pH: -8-22 / ± 1200 mV
Resolution	0.001 pH / 0.1 mV
Accuracy	± 0.003 pH / ± 0.2 mV