**Sigla: PEM5140**

Name: Thermal and Mechanical Properties of Ceramics and Glasses

Mother Area: Metallic Materials, Ceramic and Polymer (97134)

**Objectives:**

1 - Improve knowledge of the characterization and behavior of ceramics and glass, mainly from the points of thermal and mechanical view;

2 - To correlate the thermal and mechanical properties with the microstructure of the ceramics and glass;

3- Propose, based on the knowledge obtained in this course, structures, or materials with improved thermal and mechanical properties for technological applications.

**Justification:**

Both to evaluate materials known as projects of new materials, we need to know their properties. Ceramics are very important due its properties and its general applications. Its applications range from bricks and tiles for construction, through the porcelain, refractories, implants, sensors, mechanical components, catalysts, and many others. Ceramics have irregularities that make them more complicated as the theoretical and experimental evaluation of its important properties both at ordinary temperatures as at high, especially regarding the choice of the technical and reliability of the results. Usually taught in courses at graduate making approach to the material properties is given greater focus on metallic materials thus leaving a gap in the training of graduate students in the field of ceramics and glass.

**Contents:**

1 - Atomic bonds (atomic structure, chemical bonds);

2. Crystal structures of ceramics;

3- Defects (approach to ceramics - intrinsic defects and extrinsic);

4 Structures (ceramics and glass - macro, micro and nanostructures);

5- Thermal properties (heat transfer coefficient, thermal expansion coefficient, glass transition temperature);

6 Mechanical properties to common and high temperatures (elastic modulus, bending strength, compressive strength, fracture energy, fracture toughness, hardness, creep resistance to thermal shock damage);

7- Heat treatment of glass and ceramics to improve its properties (homogenization, tempering, crystallization, controlled grain growth);

8. Experimental tests involving all the above mentioned properties.

**References**

1 -Barsoum, M.W. Fundamentals of ceramics. Ed. Taylor & Francis, N.Y. 2033.

2- Kingery, W.D.; Bowen, H.K.; Uhlmann, D.R. Introduction to Ceramics, 2d. Ed. John Wiley & Sons, N.Y. 1976.

3- Acchar, W. Structure and properties of ceramic materials. Publication of the Federal University of Rio Grande do Norte, Natal, RN, 2010.

4- Lawn, B. Fracture of brittle solids. 2d Ed. Cambridge University Press, 1995.

5- Phil, W.E.L.; Ceramic Microstructure. 1ST Ed. British Library, 1994.

6- Callister, WD Materials Science and Engineering, LTC, RJ, 2008.

**Evaluation method:**

Two written tests (P1 and P2), 1 Seminar (SEM) and 1 Technical Report (REL), all with scores from 0 to 10 points.

Observation:

The final average (MF) is calculated taking into account the following equation: MF = (2P1+2P2 +SEM+REL)/6. Concepts: from 8.1 to 10 = A; from 6.51 to 8.0 = B; from 5.5 to 6.5 =C; and below 5.5 = R (rejected)