

# INTERNATIONAL ANKARA CONGRESS ON SCIENTIFIC RESEARCH VI

April 1-3, 2022  
Ankara - TURKEY

THE PROCEEDINGS BOOK

EDITOR:  
Prof. Dr. Müslüme NARİN

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*Ankara*



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# CONGRESS ID

## CONGRESS TITLE

INTERNATIONAL ANKARA CONGRESS ON  
SCIENTIFIC RESEARCH VI

## DATE and PLACE

April 1-3, 2022/ Ankara - TURKEY

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**ACRYLIC DENTAL COMPOSITES FOR DENTURES AND ADHESIVES  
MECHANICAL PROPERTIES MODIFIED USING ALUMINA, SILICA AND  
COMPOSITE LDH@SILICA PARTICLES**

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**Abstract**

An overview of advanced composite materials based on thermoplastic polymers for use in dentistry as basic materials for dentures and other industrial applications has been made. These advanced composite materials are reinforced using various oxide fillers. Alumina based particles were prepared from aluminium chloride hydroxide as starting material by sol-gel technique. One series of particles was doped with ferrous oxide. Both series of particles were calcinated at three different temperatures: 700 °C, 800 °C and 900 °C. It was investigated whether and how the calcination temperature of particles affects the microhardness and mechanical properties of composites. Another type of filler used were silica particles obtained from rice husk, as well as silica particles to which, double hydroxide particles were deposited as surface modifiers. The prepared particles were used in amounts of 1, 3 and 5 wt. % as reinforcing agents. Characterization of the synthesized particles was performed by X-ray diffraction, Fourier transforms infrared spectroscopy (FTIR) and scanning electron microscopy with EDS. The development and synthesis of two acrylate matrices are presented. One of the matrices used is polymethylmethacrylate (PMMA) which has been thermally polymerized and used for denture materials. The mechanical properties of PMMA composites, such as hardness, impact resistance, tensile test and toughness of the material, were investigated. Photopolymerizable acrylates such as Bis-GMA (bisphenol A glycidyl methacrylate)/TEGDMA (triethylene glycol dimethacrylate) were used for the second type of matrix. This matrix was used to test the adhesion between a composite film with given particles as reinforcements on a metal surface. Three different methods were used to test adhesion: determination of film hardness and quantitative assessment of bond strength according to Chen Gao model; wetting angle between composite and substrate determination; and cavitation testing. The mechanical properties of composite materials are improved by increasing the reinforcement content. It is proved that the adhesion is improved with addition of the fillers.

**Keywords:** dental composites, alumina reinforcement, silica reinforcement, LDH reinforcement