College of Engineering and Computer Science
Office of the Dean
777 Glades Road, EE96, Room 308
Boca Raton, FL 33431
561.297.3400

Announces the Ph.D. Dissertation Defense of

David Felipe Gonzalez

for the degree of Doctor of Philosophy (Ph.D.)

Enhancement of a Copolyester's Impact Resistance via Inorganic Reinforcement

July 6th, 2026, 10:00 AM – 12:00 PM
https://fau-edu.zoom.us/j/87396591679?pwd=LuniaITpImJ0mLGo8N70WtoWJveaAR.1

DEPARTMENT: Ocean and Mechanical Engineering

ADVISOR:
Hassan Mahfuz, Ph.D.

PH.D. SUPERVISORY COMMITTEE:
Francisco Presuel-Moreno, Ph.D.
Vivian Merk, Ph.D.
Tye Langston, Ph.D.

ABSTRACT OF DISSERTATION

Thermoplastic copolyester elastomers (TPEEs) are widely used in engineering applications because of their flexibility, toughness, and chemical resistance. However, prolonged exposure to marine environments can reduce their mechanical performance through moisture-induced degradation. This research investigated the use of titanium dioxide (TiO_2) nanoparticles and APTES-functionalized TiO_2 nanoparticles to improve the mechanical, thermal, and environmental durability of Hytrel 5556.

Nanocomposites containing 1 wt.% and 2 wt.% TiO_2 were fabricated through melt blending and compression molding. Mechanical properties were evaluated through tensile, compression, flexural, and impact testing, while thermal behavior was characterized using differential scanning calorimetry (DSC). Nanoparticle dispersion was examined using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Hydrothermal aging was conducted in heated saltwater to simulate subsea service conditions. FTIR analysis confirmed successful APTES functionalization through the formation of Si–O–Ti and Si–O–Si bonds on the nanoparticle surface.

TiO_2 reinforcement improved tensile, compressive, flexural, and impact performance while reducing moisture uptake during hydrothermal aging. APTES functionalization further enhanced nanoparticle–matrix interactions, resulting in substantial improvements in impact resistance, flexural strength, and flexural modulus. The 2 wt.% APTES-TiO_2 nanocomposite achieved an impact resistance of 553 kJ/m² and a flexural modulus of 244 MPa, representing increases of approximately 54% and 28%, respectively, compared with neat Hytrel. Functionalized nanocomposites also exhibited excellent property retention after hydrothermal aging. These results demonstrate that APTES-functionalized TiO_2 nanoparticles significantly enhance the mechanical performance and environmental durability of Hytrel-based nanocomposites for marine and offshore applications.

BIOGRAPHICAL SKETCH

Born in Clinton, IA, United States of America

College of Engineering and Computer Science
Office of the Dean
777 Glades Road, EE96, Room 308
Boca Raton, FL 33431
561.297.3400

B.S., Ocean Engineering, Florida Atlantic University, Boca Raton, FL, USA, 2022
M.S., Ocean Engineering, Florida Atlantic University, Boca Raton, FL, USA, 2024
Ph.D., Ocean Engineering, Florida Atlantic University, Boca Raton, FL, USA, 2026

CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

Time in Preparation: 2022 - 2026

Qualifying Examination Passed: Fall 2024

Published Papers:

• Charnelle Parchment, David Gonzalez, Hassan Mahfuz, Tye Langston, "A Reinforced Polymer Structure for Diving Suits to Replace Foamed Neoprene" ASME International Mechanical Engineering Congress (IMECE), November 17-21, 2024, Portland, Oregon, presented and abstract published.

• David F. Gonzalez, Hassan Mahfuz, Vivian Merk, Francisco Presuel-Moreno, Alejandra Coronel-Zegarra, Fariha Binthe Rahman, "Nanostructured Thermoplastic Elastomers Reinforced with Anatase TiO_2 for Offshore and Subsea Applications" in Proceedings of the Thirty-sixth (2026) International Ocean and Polar Engineering Conference, Orlando Florida, USA, ISBN: 978-1-880653-72-2; ISSN: 1098-6189

• David F. Gonzalez, Hassan Mahfuz, Vivian Merk, Francisco Presuel-Moreno, Alejandra Coronel-Zegarra, Fariha Binthe Rahman, "Enhanced Mechanical and Thermal Performance of a Thermoplastic Copolyester Elastomer via Anatase TiO2 Nano-Reinforcement", submitted to *MRS Advances* in conjunction with MRS Spring Presentation, May. 2026.

• David F. Gonzalez, Hassan Mahfuz, Vivian Merk, Francisco Presuel-Moreno, Alejandra Coronel-Zegarra, Fariha Binthe Rahman, "Thermoplastic Copolyester Elastomer Reinforced with APTES-Functionalized Anatase TiO_2 for Subsea Applications" invited to publish with *Journal of Material Research (JMR),* Aug. 2026.