# Spectrally-Quantified Chemical Reactivity Testing of Optical Fluids and Materials in the GMACS Spectrograph for GMT

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## Introduction

The Texas A&M Astronomical Instrumentation Laboratory shares responsibilities in the Giant Magellan Telescope (GMT). The Giant Magellan Telescope is a large adaptive optics, ground-based telescope planned for completion in 2018. It will consist of seven 8.4 diameter mirror segments and will perch atop of Las Campanas Observatory in Chile. One of our lab's responsibilities is to design and build a wide field, multi-object, moderate-resolution optical spectrograph (known as GMACS[1]) for GMT. Our spectrograph will aid GMT in its science goals of observing galaxy assembly, dark energy, first light, and reionization. GMACS is an integral part of GMT and because of this, it is important to ensure the integrity of the GMACS spectrograph for the decades that it will be in operation.

Recently, several spectrographs have been compromised by the corrosive nature of optical fluids with some materials. Two years after the commissioning of the Robert Stobie Spectrograph (RSS[2]) on the Southern African Large Telescope, astronomers noticed a significant loss of ultra-violet transmission. With great difficulty and time lost, they diagnosed that the optical fluids had become contaminated by the materials that they had corroded and these contaminates blocked UV light.

Furthermore, other astronomers have taken a preemptive approach to this problem. When designing the Deep Imaging Multi-Object Spectrograph (DEIMOS[3]), the team at UCO/Lick Observatory did a preliminary 3-month test of several optical fluid and material candidates for DEIMOS. With their research, they qualitatively identified and avoided many incompatible fluid and material pairs.

## Objective

In our research, we seek to conduct similar tests as those conducted by the UCO/Lick team. We want to augment these tests by using spectral transmission data of the fluids to obtain exact quantitative results. With our research, we hope ensure the integrity of the GMACS spectrograph and to provide information for future spectrograph instrumentation.

## Methodology

We wish to study several candidate fluids and materials for GMACS. After compiling a complete list of candidates, we will fill UV cuvettes with sample fluids and submerge in that fluid a small sample of material (vulcanized rubber, silicone, Teflon, etc.). Many possible combinations will be tried.

Since the effects we wish to study set in after several years, these will be long-term test. But to acquire results in a timely manner, we will accelerate the corrosion process by heating samples in an oven for months at a time. The thermal excitation will create more molecular collisions and thus more corrosion. With this technique, our research may be completed in 5 months or less.

During the course of the study, we will remove the samples from the oven for periodic observations. Measurements will be made by shining UV light through the cuvettes and by recording the resulting transmission curve in a standard tabletop spectrometer.

## Summary

Recently recognized incompatible parts have cost some observatories great time and money. To prevent this from happening in our spectrograph, we seek to prescreen our parts using a novel approach. We will use an oven to accelerate our study's timeframe and a spectrometer to quantify our results. Our data will ensure the integrity of GMACS and future spectrographs.

**Bibliography**


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