U N I V E R S I T Y of H O U S T O N

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Dear Ms. Higgins:

I am pleased to write a very strong letter supporting Dr. Mike Melnichuk's application for a postdoctoral position in your group. Mike began working closely with me six years ago, and during this period of interaction, he has shown outstanding capabilities in both experimental and theoretical physics.

When Mike joined my group, we were developing an optical technique to study the time evolution of surface relief in a single crystal of a nickel aluminum alloy, a material that undergoes a martensitic transformation. We were able to show that the surface relief develops in microbursts with time scales on the order of microseconds to milliseconds. Furthermore, our model indicated that the aspect ratio of the surface structures remained constant throughout their growth.

I suggested to Mike that we should try to extend similar techniques to study ferroelectric materials. Within certain limitations, I try to allow students the flexibility to choose their own research problem. I believe their interest level remains higher under these circumstances. Mike began reading books and journal articles and finally decided that a good test of extending our previous work would consist of measuring the twin angle in a barium titanate sample using optical diffraction methods. This turned out quite nicely, as he was able to measure the diffraction effects when the twinning occurred and create a model of the diffraction from the structure. In fact our measurements were quite consistent with other methods that use much more expensive equipment. This work has been published in Applied Optics.

To carry out additional work on barium titanate, Mike designed a unique optical modulator where a rotated Wollaston prism allowed him to observe two independent polarization states simultaneously. The rotation created an additional phase difference that improved the sensitivity of his measurements. Using this configuration, he carried out experiments where he determined for the first time two off-diagonal Kerr coefficients in tetragonal barium titanate. The key to this measurement was Mike's realization that it was possible to configure an applied electric field to suppress the effects of the first-order Pockels effect. The approach that Mike developed is applicable to many materials, and it can be used to measure off-diagonal Kerr coefficients in 18 of the 20 noncentrosymmetric crystal point groups where the Pockels effect and the Kerr effect coexist. This work was recently published in the Journal of the Optical Society of America A.

Finally, Mike measured optical transients in tetragonal barium titanate using the same setup. He measured the effects on polarized light transmission during excitation (abruptly turning on an electric field), switching (inverting the applied electric field), and

relaxation (opening the electric circuit providing the potential difference across the sample). Mike developed the models treating the circuit as a combination of capacitors, with the barium titanate serving as one element. He was able to extract time constants for each excitation and obtain values for the resistivity of barium titanate. This work has been published in the Journal of the Optical Society of America A.

Most recently, Mike extended some of the ideas in the experimental work to give a rather complete discussion of the possibility of measuring many of the Kerr and Pockels coefficients for materials in 18 of the crystallographic point groups. This work will appear in the Journal of the Optical Society of America A this coming May.

My point in relating all this information is to emphasize that Mike has been the leader for the major part of this work. I have provided advice and helped him past a few rough spots, but the major ideas are his, even the project itself. Mike has been one of the most competent and independent graduate students I have ever supervised. He is extremely thorough in his literature searches. He checks and rechecks his derivations carefully, and his experimental work is first class.

Last year, we noticed an advertisement for abbreviated proposals from NIST (Precision Measurement Grant), and we thought it would be worthwhile to apply based primarily on the possibility that Mike's work might result in a new field of work. Mike wanted to gain experience in proposal writing, so he wrote much of the proposal, and together we polished it.

In summary, Dr. Mike Melnichuk is a very capable physicist and a person with great integrity. He has excellent experimental skills, his knowledge base in theoretical physics is solid, and he is dedicated to his research. The only area where I am unable to provide much insight is how he functions in group efforts. Mike's project was somewhat different from all other persons, so there was not much chance for detailed interaction. I certainly have no reason to doubt his ability to work well with other persons. I give Mike an enthusiastic recommendation without reservation. He has the potential to develop into an extraordinary physicist. If you have questions, please contact me at (713) 743-3560.

Sincerely,

Lowell Wood
Professor