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13. SUPPLEMENTARY NOTES					
14. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.					
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Final Report
to the Air Force Office of Scientific Research
for a program in

***In situ* Absolute Temperature Control of Growing
Thin Films of the Complex Oxides**

Grant No. AF49620-99-1-0237

for the period 1 May 1999 to 30 April 2000

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November 2000

Final Report

***In situ* Absolute Temperature Control of Growing Thin Films of the Complex Oxides**

This contract was for the purchase and commissioning of a Fourier Transform Infrared (FTIR) spectrophotometer capable of determining *in situ* the absolute temperature of a growing high temperature superconductor thin film. Such measurement has not been accomplished heretofore and is thought to be critical for achieving good control of the growth process.

The FTIR thin film monitor was delivered by On-Line Technologies, Inc., in May 2000. On May 9 and 10, 2000, the designer-engineer of this instrument, Jiazhan Xu, arrived from Connecticut to install it and instruct the Stanford students and postdoctoral researchers in its operation. He was assisted by the local representative, Dr. Matt Richter.

The original installation was on a bench top with a test sample heated by a hotplate. The infrared source and spectrometer were located at distances and angles with respect to the sample that approximated those expected in actual application. Using a known sample, a silicon wafer, with a known emissivity, the instrument was calibrated and checked through a range of temperatures. After several postdoctoral researchers and students learned to use the instrument, it was declared operational.

One fact, of its operation is that spectral reflection of the infrared light off the sample into the spectrometer is assumed in determining the emissivity. This could be a problem in its practical application since growing films are not necessarily sufficiently smooth—i.e., roughness can develop. Another factor is the angle of the sample required to reflect into the spectrometer's axis of acceptability. A test protocol was developed to explore these issues. Samples of different roughness were selected, again on the bench set up, and a hotplate used to vary the temperature. These tests were conducted by an undergraduate student employed for the summer, supervised by Professor Mike Kelly. A qualitative understanding of this issue was achieved.

The first actual use of this instrument will be in the electron beam evaporator used for high temperature superconducting YBCO coated conductor research. This will be very important, because it is believed that the temperature of the deposit, including a possible liquid stage, is vital in controlling the growth of high J_c YBCO. The evaporator bell jar top has had special ports installed to allow the FTIR to see the substrate, and is now being installed in the new Geballe Laboratory for Advanced Materials at Stanford. It will soon be in operation.