METHOD OF CHARACTERIZING LAYER THICKNESS

TECHNICAL FIELD

The present description relates generally to methods of characterizing layer thickness using a terahertz pulse.

BACKGROUND

A terahertz measurement system can be used to measure various properties of a sample.

SUMMARY

In one aspect, the present description provides a method of characterizing one or more layers of a material. The method includes irradiating the material with a THz pulse such that at least a portion of the THz pulse is reflected from the material as a reflected THz signal; acquiring a first time-domain waveform of the reflected THz signal; using a neural network on a computing device to map the first time-domain waveform to a second time-domain waveform defined by a superposition of a plurality of peaked time-domain interface waveforms, where each peaked time-domain interface waveform has a peak corresponding to a reflection from an interface of the material; and determining one or more proportional thicknesses of one or more layers of the material from a corresponding one or more spacings between adjacent peaks of the plurality of peaked time-domain interface waveforms.

In another aspect, the present description provides a method of training a neural network for characterizing one or more layers of a material using a THZ pulse. The method includes training the neural network on a computing device using training data to determine parameters of the neural network. The training data includes input data and output data. The input data includes time-domain waveform data corresponding to at least partial reflection of a THz pulse from each test sample of a first plurality of test samples. The output data includes a time-domain output waveform for each test sample of the first plurality of test samples. Each time-domain output waveform is defined by a superposition of a plurality of peaked time-domain interface waveforms. Each peaked time-domain interface waveform has a peak corresponding to a reflection from an interface of the test sample.

An embodiment of the first aspect further includes generating training data for a neural network. The training data includes input data and output data. Generating training data includes determining the input data as time-domain waveform data corresponding to a first plurality of test samples via computer simulation of at least partial reflection of a THz pulse from each test sample of the first plurality of test samples; and for each test sample in the first plurality of test samples, determining a time-domain output waveform as a superposition of a plurality of peaked time-domain interface waveforms. Each peaked time-domain interface waveform has a peak corresponding to a reflection from an interface of the test sample. The output data includes the time-domain output waveform.

In an embodiment, the present description provides a method of characterizing thickness of at least one layer of a material. The method includes irradiating the material with a THz pulse such that at