Optical Observation of Spontaneous Heat Burst Phenomena during Hydrogen Desorption from Nano-sized Metal composite

Takehiko Itoh[1,2], Yoshinobu Shibasaki[2], Jirohta Kasagi[1],
Tomonori Takahashi[2], Mari Saito[2] and Yasuhiro Iwamura[1]
1 Research Center for Electron Photon Science, Tohoku University, 982-0826 Japan
2 CLEAN PLANET Inc., 105-0022 Japan
E-mail: itoh@lns.tohoku.ac.jp

We have been conducting research on anomalous excess heat (AEH) generation phenomena using hydrogen and nano-sized metal composite. Up to the present, we succeeded in observing the AEH that cannot be explained by the chemical reaction [1,2]. In addition, we often observed heat burst phenomena, in which the temperature of the heater suddenly rises [2]. Observing this phenomenon in detail is one of the ways to understand the mechanism of the AEH production. Recently, experiments have been conducted by adding light radiation to temperature measurement [3]. In the present work, we report on the latest results measured by a group of photodetectors. The sample mainly examined is a Ni/Cu nano multilayer film which is deposited on Ni substrates by sputtering.

The experimental process is as follows. First, two films are fixed on both sides of a ceramic heater in a sample holder installed in the vacuum chamber. Next, the samples are sufficiently baked out in a vacuum, and then H_2 gas is introduced into the chamber to 200 Pa, the heater temperature is kept at 250 C for about 15 hours to allow the samples to absorb hydrogen. Finally, we heat the samples up and keep the heater input power constant, while evacuating the chamber to release hydrogen from the samples: This induces the AEH generation.

In the experiment, the heater temperature was continuously measured together with the light radiation emitted from the surface of the sample. Attempted was the simultaneous detection of light radiations when the heat burst occurred. Used photodetectors are TMHK-CLE1350 (wavelength 3-5.5 μm) for mid-IR, an FTIR spectrometer Hamamatsu C15511 (1.5-2.5 μm) for near-IR, and a spectroscope Hamamatsu C10027 (0.3-0.9 μm) for visible light.

Fig. 1 shows typical heat bursts occurring spontaneously: a plot of the temperature and radiant intensities as a function of elapsed time. Red, green, brown and light-blue lines are heater temperature, radiant intensities measured in mid-IR, in near-IR and in visible light, respectively. Many sudden increases are clearly seen in every line and they are temporally synchronized, even though the heater input power is constant. This suggests that there is sudden energy generation in the sample, part of it is dissipated quickly by radiation from the surface and is partly propagated to the inside as to rise the heater temperature.

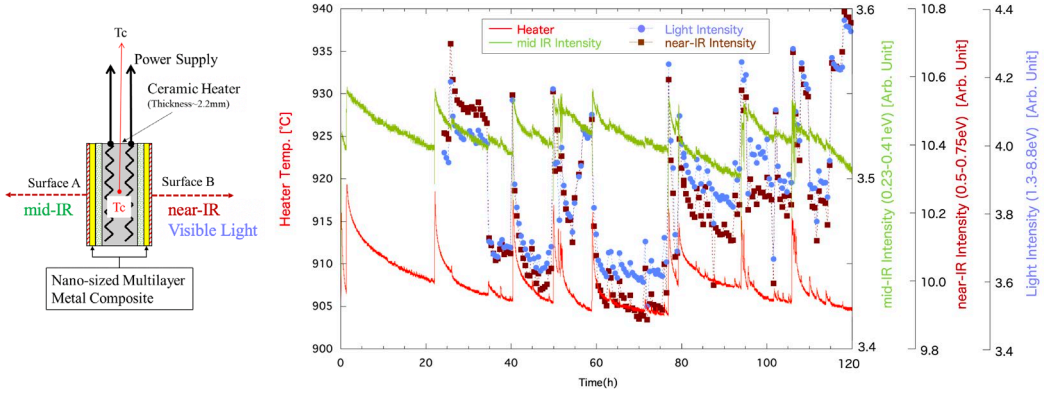

Fig.1 Typical heat bursts occurring spontaneously

References

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