ing a change in tunnel current in the xy plane (tunnel current image measurement mode).

Further where the sample/probe distance is kept constant, the dependence of a tunnel current upon a tunnel bias voltage and the differential conductance of the tunnel current can be measured (tunnel spectrum measurement mode).

As is described above, to detect a tunnel current flowing between the probe *7a* and sample **1** with the distance therebetween kept constant, excitation light is intermittently emitted onto the sample, thereby measuring the distribution of photoconductivity in the xy-plane, the dependence of an excited tunnel current upon a bias voltage, and the excited spectrum (action spectrum) of the excited tunnel current.

Thus, while the tunnel current flowing between the probe *7a* and sample **1** is being detected with the distance therebetween kept constant, measurements as regards the xy-plane distribution of tunnel emission light from the sample **1**, the wavelength dependence of the emission light, and the relationship between the bias voltage and emission light intensity are performed.

FIG. **15** shows a variation of the above-described embodiment. In the figure, the same reference numerals as those in the above embodiment denote similar elements, and explanation thereof will be omitted. In this variation, an optically opaque film **160** is formed on the surface of a probe *7a* except for the tip portion thereof. To observe light, such as fluorescence, emitted from the sample surface when it is excited by excitation light, it is desirable to prevent the excitation light from entering into the observation optical system. The optically opaque film **160** is made of carbon, which enhances the conductivity of the probe, and serves as a reflection film for scattering the excitation light on the surface of the probe to thereby prevent the light from entering into the probe, i.e., to prevent the light from entering into the sample observation optical system. In addition, if the refractive index distribution of the end of the optical fiber is changed by ion exchange, the same effect as in the case of forming the tip of the fiber **134** like a convex lens can be obtained. In this case, an optical fiber having a diameter larger than the width (120 &L m) of the cantilever can be used in the apparatus, thereby enhancing the resonance frequency of that portion of the fiber which is located under the fiber supporting portion.

FIG. **16** shows another variation of the embodiment. In the figure, the same reference numerals as those in the above embodiment denote similar elements, and explanation thereof will be omitted. In this variation, the tip portion of a probe *7a* is rounded, and has a function similar to that of a convex lens. Accordingly, excitation light is converged onto a sample **1**. The same effect as above can be obtained by changing the refractive index distribution of the tip of the probe *7a*, instead of rounding the same.

FIGS. **17** and **18** show further embodiments of the invention. FIG. **17** shows structural elements necessary for optically observing the sample surface, whereas FIG. **18** shows structural elements necessary for detecting light emitted from the sample surface. In FIGS. **17** and **18**, the same reference numerals as those in the above embodiment denote similar elements, and explanation thereof will be omitted. In this embodiment, displacement detection light is emitted to the cantilever **7** via an optical fiber **134**, and displacement of a probe *7a* is detected as in the above-described embodiment. Excitation light emitted from an excitation light source **184** enters into a lens **180** via an excitation light filter **182**, is then reflected by a dichroic half mirror **178**, thereafter converged by an objective lens **124**, and emitted onto the sample **1** through a cantilever **7** and a glass plate **116**. As is shown in FIG. **17**, the light reflected by the sample **1**, i.e., observation light containing optical data regarding the sample surface, passes the dichroic half mirror **178**, and is converged by a lens **186** into a CCD **188**, where an optical image of the sample surface is observed. On the other hand, to detect the light emitted from the sample surface, a filter **190**, a lens **192**, and a photoamplifier **194** are provided in place of the lens **186** and CCD **188**, as is shown in FIG. **18**. The light emitted from the sample surface is converged by the objective lens **124**, then passing the dichroic half mirror **178**, entering into the lens **192** through the filter **190**, and being converged into the photoamplifier **194**, thereby being detected as an electrical signal. In the structure of the embodiment, though the positional resolution of the excitation light is low, the intensity of the excitation light can be increased.

FIGS. **19A** and **19B** show a variation of the above embodiment. In this variation, a bolometer **196** is provided in the interference reflecting film formed on the free end of the cantilever, for monitoring the intensity of the excitation light utilizing the film's property of absorbing the excitation light. FIG. **19A** is a plan view of the bolometer **196** and glass plate **116**, while FIG. **19B** is a cross sectional view thereof. The intensity of the excitation light can be kept constant by controlling the driving circuit of the excitation light source in a feedback manner on the basis of an output from the bolometer **196**.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, and representative devices shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

What is claimed is:

1. A microscope comprising:

a probe;

a cantilever having a free end portion supporting the probe;

selective reflection means provided on the free end portion of the cantilever, for reflecting displacement detection light and for passing sample examination light therethrough;

scanning means for causing the probe to scan the surface of a sample while controlling the distance between the probe and the sample to be substantially constant, which distance would otherwise vary due to an interatomic force exerted between the probe and the sample;

light source means for emitting the displacement detection light and the sample examination light;

guide means for guiding the displacement detection light and the sample examination light to the selective reflection means provided on the cantilever, the displacement detection light being reflected by the reflection means, the sample examination light passing through the reflection means and being radiated onto the surface of the sample, resulting in that a radiated portion of the surface of the sample generates characteristic light indicative of the characteristics thereof;