[0048] When electromagnetic radiation **15** is incident on the antennas **21** the antennas **21** may absorb the electromagnetic radiation **15**. This may cause an increase in temperature of the antennas **21**.

[0049] The shading of the antennas **21** in the FIG. **2** provides an indication of the temperature of the antenna **21** in response to incident electromagnetic radiation **15**. The darker regions indicate the regions with a higher temperature. It can be seen in FIG. **2** that the heating of the antenna **21** is distributed across most of the antenna **21**.

[0050] As the antennas **21** act as the contacts **9**, **11** they may be in direct contact with the pyroelectric material **4** as illustrated in FIG. **1**. This may enable heat to be transferred from the antennas **21** to the pyroelectric material **4**. As the antenna **21** may concentrate the effect of the incident electromagnetic radiation this may cause a larger change in temperature than would be achieved without the antenna **21**. The larger change in temperature of the contacts may provide for a larger change in the temperature of the pyroelectric material **4** which may provide a larger response of the graphene **7**.

[0051] The size and shape of the antennas **21** may be chosen such that the heating is more efficient for particular wavelengths of incident electromagnetic radiation **15**. For example the antennas **21** may be selected to have a resonant wavelength in the infrared region of the spectrum.

[0052] In the particular example of FIG. **2** both of the antennas **21** have the same size and shape. In other examples the antennas **21** may have different sizes and/or shapes. This may enable them to be responsive to different wavelengths of incident electromagnetic radiation **15**.

[0053] The material selected for use as the antenna **21** may comprise a high loss material. This may cause a larger amount of heating for a given amount of incident radiation.

[0054] FIG. **3** illustrates another apparatus **10** according to an example of the disclosure. The apparatus **10** of FIG. **3** also comprises a sensor **1** and at least one antenna **31**. In the example of FIG. **3** the antenna **31** is a plasmonic antenna **31**. The sensor **1** may be as described above in relation to FIG. **1**. In FIG. **3** the sensor is illustrated in plan view so only the graphene **7** and the contacts **9**, **11** are shown. The sensing portion **3** would be positioned underneath the graphene **7**.

[0055] In FIG. **3** only one plasmonic antenna **31** is provided. It is to be appreciated that more than one plasmonic antenna **31** may be provided in other examples.

[0056] The plasmonic antenna **31** is provided separate to the contacts **9**, **11**. The plasmonic antenna **31** may be provided so that there is no direct metallic short between the contacts **9**, **11** and the plasmonic antenna **31** other than the graphene channel itself.

[0057] In the example of FIG. **3** the plasmonic antenna **31** is provided in the middle of the graphene **7** channel between the two contacts **9**, **11**. It is to be understood that, in other examples, the plasmonic antenna **31** could be positioned at any point along the graphene **7** channel.

[0058] The plasmonic antennas **31** may be configured to enable the electromagnetic field of the incident electromagnetic radiation **15** to be concentrated into a gap **33**. The gap **33** may be a small gap. The gap **33** may be smaller than the resonant wavelength of the antenna **31**. For example, the gap **33** may be in the region of 50-200 nm.

[0059] The plasmonic antennas **31** may have any suitable size and/or shape so as to enable the electromagnetic field of the incident electromagnetic radiation **15** to be concentrated into the gap **33**. In the example of FIG. **3** the antenna **31** has a bow tie geometry. The antenna **31** comprises two triangles separated by a small gap **33**.

[0060] In the example of FIG. **3** the triangles are isosceles triangles and the apex of the first triangle is positioned close to the apex of the second triangle. The gap **33** is provided between the two apex.

[0061] The shading of the antenna **31** in FIG. **3** provides an indication of the heating of the antenna **31** in response to incident electromagnetic radiation **15**. The darker regions indicate the regions with a higher temperature. It can be seen in FIG. **3** that the heating of the antenna **31** is localised in the apex of the triangles and in the small gap **33** between the two apex.

[0062] The increase in temperature in the gap **33** may cause an increase in the temperature of the graphene **7** directly underneath the gap **33**. This may, in turn cause an increase in temperature of the pyroelectric material **4** directly underneath the graphene **7**. As the heating effect is localised in a small area this may lead to a relatively large increase in temperature for that area. The increase in temperature may be large compared to the increase in temperature which would occur if same amount of electromagnetic radiation was directly incident on the sensor **1**.

[0063] The size and shape of the plasmonic antenna **31** may be chosen such that the heating is more efficient for particular wavelengths of incident electromagnetic radiation **15**. For example the plasmonic antenna **31** may be selected to have a resonant wavelength in the infrared region of the spectrum.

[0064] In some examples the plasmonic antennas **31** may be coupled to one or more plasmonic lenses. The plasmonic lenses collect the incident electromagnetic radiation from a large surface are. The effective surface area of the lens may be large compared to the surface are of the sensor **1**. The collected radiation can then be focused onto the plasmonic antenna **31**. The plasmonic lenses may comprise one or more metal discs.

[0065] In the examples of FIGS. **2** and **3** the antennas **21**, **31** have a bow tie geometry. Other shaped antennas **21**, **31** may be used in other examples of the disclosure.

[0066] For example, the antennas **21**, **31** may comprise two rectangles separated by a small gap or two discs or ellipses separated by a small gap.

[0067] The shape of the antenna **21**, **31** which is chosen may depend on a number of factors. One such factor may be the wavelength of the electromagnetic radiation which the antenna **21**, **31** is intended to be responsive to. If the antenna **21**, **31** is chosen to be responsive to infrared radiation then the antenna **21**, **31** may be a bow tie antenna **21**, **31** or two rectangles. Such antenna **21**, **31** may need to be responsive to an electromagnetic radiation having a wavelength in the range of micrometres. In other examples the antennas **21**, **31** may be chosen to be responsive to visible light. In such examples the antenna **21**, **31** may need to be responsive to radiation with a wavelength in the range of nanometeres and it may be difficult to manufacture an antenna **21**, **31** having an intricate shape such as a bow tie at the desired resolution. Therefore for wavelengths in the visible region of the spectrum the antenna **21**, **31** may be disc or circle or ellipse.

[0068] The apparatus **10** described above provides an apparatus **10** which may be used for sensing electromagnetic radiation including electromagnetic radiation in the infrared region of the spectrum.