What are fractal interfaces?

In geometry, we have well defined shapes in one, two and three dimensions like straight lines, planes, circles and spheres. Various objects in the real world are rarely so well defined.

Let us consider different variants of supposedly planar surface as shown in Figure below. The side view of such a plane will look like a line. For a perfectly planar surface, it would be a straight line as (1) in the Figure.

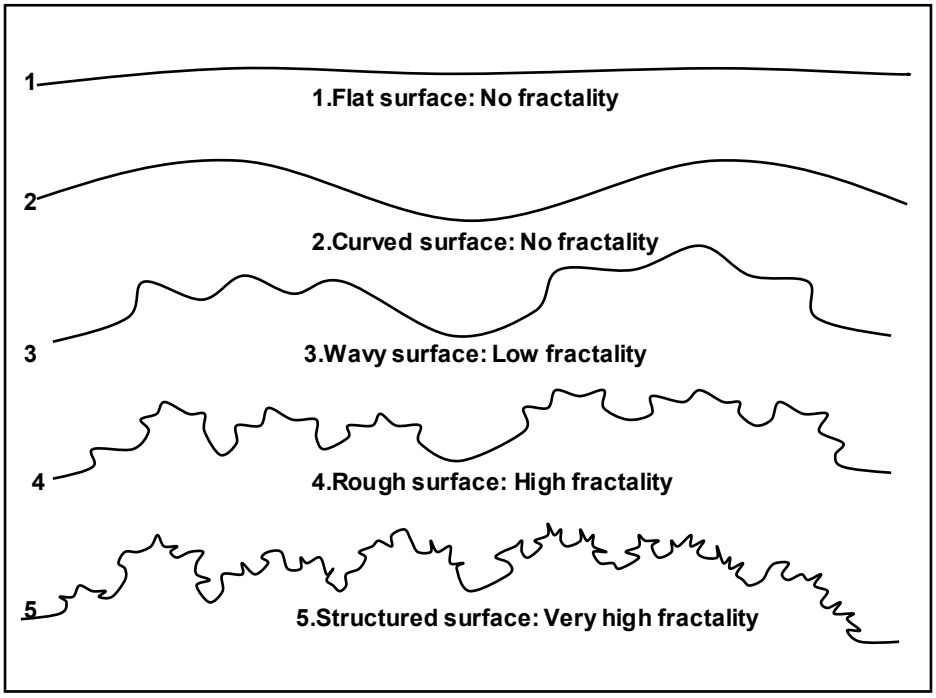

Figure: Fractal Surfaces

However, real life surfaces are not perfectly planar. Side view of such a surface will look like a straight line from a far distance. As one keeps approaching closer to the surface, the side view will appear less and less like a straight line. This is illustrated in the lines 2 to 5 in the Figure1. As one gets at very close range of perception, the surface appearance is extremely jagged. Although, it might appear that at microscopic scale, the surface is irregular and disorderly from conventional geometric viewpoint, there is another type of regularity in such surfaces. Line no 2 consists of two waves or warps. Line no 3 shows that these two warps further comprise of smaller warps. Further line no 4 shows even smaller warps which in turn are full of

finer warps as shown by line 5. Thus in reality the surfaces are made up of self-similar replicating features of progressively finer size. This is called fractality. Changing the viewing position from macroscopic to microscopic actually implies the change of scale of measurement. Distant viewing may be on a centimeter scale (Line 1) and closest possible view may be of a nanometer scale (Line 5). We can also see that the length of the line will change with the scale. Length of Line 1 can be measured by a foot rule where as length of line 5 can be measured by a nanometer scale. Length of line 1 will thus be the shortest and the line 5 the longest. Since this is a cross-sectional side view, the length of the line actually means the area of the surface. Thus actual surface areas of the real life surfaces are often governed by fractality. The magnitude of the surface area is inversely proportional to the scale of measurement. The finer the scale of measurement, the larger the surface area.

There will be a limiting value to the finer scale of measurement which will lie in the nanoscale region. There will be no further fractality beyond atomic (or molecular) scale.
