It is remarkable that multilayered integrated circuits are being manufactured successfully

High-resolution coherent diffractive imaging technique can create three-dimensional images of integrated circuits

The active transistor layer is at the bottom while other layers mainly consist of metal interconnects

The measured structure and design match perfectly

The colors of the wires in the schematic are the same as those of the wires used in the 3D rendering

The slice contains the transistor layer where we can identify repetitive structures

The tomographic imaging geometry required the extraction of cylindrical pillars from the chips that are initially flat extended objects

Xray ptychography promises to solve the chip inspection problem

This would enable optimization of production processes

There is a perfect match between the design and measured layers

Xray tomography is an invaluable tool in biomedical imaging

Most frequently such information is based on Xray attenuation

We expect this high-resolution tomography technique to provide invaluable information for both the life and material sciences

The transistor map is converted into the actual IC design

Downside of the high penetration power of Xrays is their low absorption contrast

The associated length scales cover a wide range from centimeters down to nanometers

Unlike in traditional Xray microscopy the recovered images are complex-valued map

The reconstruction does not rely on assumptions of homogeneity, negligible absorption, or small phase advance

We report the implementation of ptychographic Xray computed tomography

The resulting difference in signal-to-noise ratio is apparent in the line profiles

All measurements were performed at a photon energy

The integrated micromanipulator was used to mount the sample on the holder for the tomography measurement

The measurement conditions were identical to those for the tomographic measurement of the pillarshaped Intel sample

The laminography measurement geometry combined with foreseeable improvements in Xray source

The small blue circles correspond to the scanning points of the ptychographic scan

One can also clearly identify the transistor gates, but we cannot distinguish between p and n type transistors

The repetitive structures become even more evident when looking at slices

The interconnect layers are vertically connected to each other by vias with hollow interiors

Our experiments represent a major advance in chip inspection and reverse engineering

There is a growing number of applications which require both quantitative and sensitive investigation methods

All measurements were performed at a photon energy

The integrated micromanipulator was used to mount the sample on the holder for the tomography measurement

The measurement conditions were identical to those for the tomographic measurement of the pillar-shaped Intel sample

Detailed descriptions of ptychography can be found in a number of earlier publications

Ptychography is a method that utilizes overlapping scanning areas to give high resolution reconstructions

A specimen is illuminated with a finite and coherent incident wave called the probe

The laminography measurement geometry combined with foreseeable improvements in X-ray source

Coherent diffractive imaging provides high resolution images through computational reconstruction

A complete dataset consists of a set of such diffraction patterns

There is a perfect match between the design and measured layers.