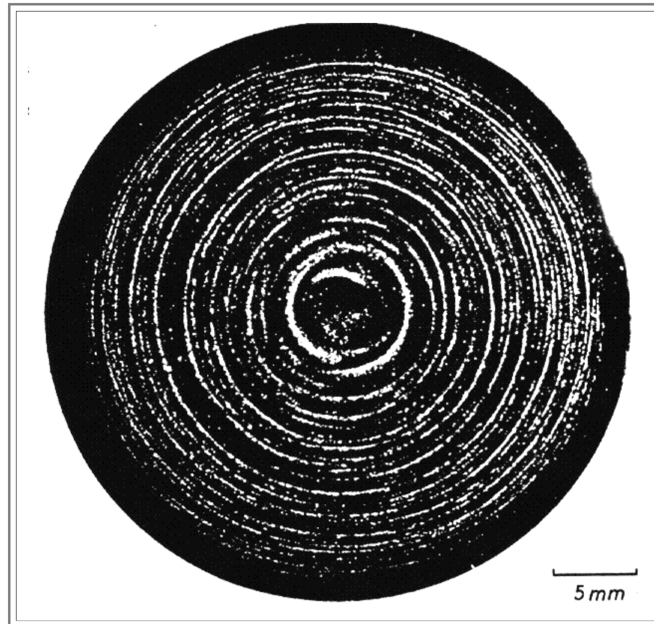
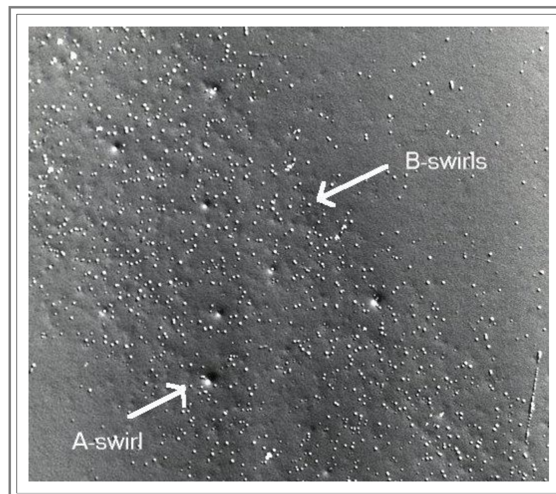
Swirl Defects

Illustration

- Swirl defects were discovered in the seventies in large dislocation-free Si crystals grown for micro electronic applications. They occur in two variants, the so-called **A**-swirl and **B**-swirl defects. The following picture shows a photography of a Si wafer that was preferentially etched to delineate the defects obtained by illuminating from the side (so that only light scattered at the defects enters the lens of the camera).
  - The typical spiral or swirl-like pattern explains the name of the defects.



  - Looking at the etch pattern with a microscope at high magnifications shows that there are a lot of small defects (the B-swirls; white dots) and a much smaller number of larger defects (**A**-swirls; the black-white contrasts). Quantitative evaluation of the micrograph shows that the **B**-swirls are delineated as small and shallow pits whereas the **A**-swirls are delineated as hillocks.



- Swirl defects are generated by the agglomeration of point defects while the crystals cools. The Si crystal growing industry soon learned how to grow crystals without swirl defects - without ever understanding precisely what they were.
  - But that did not mean that the crystals were defect free - it only meant that the methods employed then did not detect what was there. With new methods, defects reappeared, now called D-defects and bother the chip industry.
  - More about swirls can be found in a original research paper (in German) in the link.