Win Labuda et al.

On the purity of functional surfaces

Contents: Collected publications

Cleanliness-oriented measuring and testing technology
Procedures of wiping cleaning
Consumables for clean technology

BOOK CONTENT
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with a foreword by Heinz-Josef Kiggen

Introduction by Heinz-Josef Kiggen

Before the 1970s, what we now call HiTech industries were still few and far between and their demand for clean manufacturing methods was low. In the 1970s, however, the fledgling semiconductor industry began to pick up speed, and this development required more and more high-purity materials, machines and manufacturing processes.

In line with an international trend originating in the USA, ’low-particle’ production rooms with clean workbenches quickly became larger cleanrooms with laminar flow air circulation. The production yields of the semiconductor manufacturing processes were still quite modest at the beginning. However, the semiconductor industry quickly learned that one of the prerequisites for optimizing yields was to reduce particle concentration. Soon, the detrimental influence of ionic contamination on the manufacturing processes and the long-term reliability of the circuits was also recognized. A variety of measures were introduced to keep harmful contamination out of the process.

To this end, cleanroom personnel were first provided with clean overalls, gloves and face masks. The staff in the overalls passed through airlocks before entering the cleanrooms. Cleaning intervals with low-ion cleaning agents were developed for the cleanroom and its machines. Particle measuring devices and monitoring systems were developed and refined to limit contamination and to monitor the necessary reduction measures.

At the beginning of the 1980s, process engineers were still quite carefree when it came to selecting cleanroom consumables, probably because process-based yield optimization initially had clear priority. However, overalls, gloves and chemical cleaning agents soon came into the focus of the production engineers. Eventually, the complexity of wiping cleaning processes was recognized once it was realized that the cleanliness of, for example, plasma etching machines had a direct impact on the downtime of these extremely expensive machines and thus on productivity.

Already in the mid-seventies, Win Labuda, the main author of this book, had supplied a German electrical company with his high-temperature cleaning felts for laser toner printing systems. Soon another need arose: Wipers of the required material purity and cleaning effectiveness for cleaning IBM memory disks. At that time, these were only available in the USA. A visit to Mr. Edward Paley of the US company Texwipe Inc. in 1974 had opened Labuda‘s eyes to the fact that a large worldwide market would develop in the field of textile consumables of high material purity for later use in the cleanrooms of the semiconductor industry. Initially, Labuda sold Texwipe products in Germany as an independent distributor. Then, in the mid-1980s, Labuda‘s start-up Clear & Clean GmbH received an order from the Siemens semiconductor plant in Regensburg for the long-term supply of HiTech wipers and other cleanroom consumables to the Megabit Waferfab Regensburg. The order was, however, conditional on the establishment of ongoing quality monitoring by Clear & Clean with a set of testing instruments specified by Siemens. The obligation to acquire and document special material and production expertise that arose from this requirement ultimately led to the founding of the Clean & Clean research laboratory in 1990.

Win Labuda was the right man at the right time for us in the semiconductor industry in the mid-eighties. He had the experience in the production of technical textiles, was a highly committed product developer and was willing to take over the development of the complicated testing technology for purity-graded textile products for us. We didn‘t have that in the semiconductor industry and we didn‘t want to invest in it. One of Labuda‘s concerns—especially in the context of its committee work—was the development of practical simulation methods for realistic product testing. Accepted standard testing methods proved time and again to be out of step with actual practice: for example, when evaluating a HiTech cleaning wipers, it is less important to know how many particles are in the cloth when it is delivered. Whereas, it is very important to know how many remain on the cleaned object surface at the end and contaminate it.

In the past 40 years, Labuda has published 40 technical papers and given countless lectures. Since the early 2000s, he has focused his research on surface cleanliness, the physics of the wiping cleaning procedure and the chemical decontamination processes of textile materials. This book, which he is now presenting on the occasion of his 85th birthday, is Labuda‘s ’opus magnum’. It contains a wealth of knowledge from 50 years of both actively pursued clean technology and purity research. In this sense, the work is a natural addition to the VDI standard work ’Reinraumtechnik [Cleanroom Technology]’ by Gail/Gommel and an important contribution to cleanroom technology par excellence.

Dr. rer. nat. Heinz-Josef Kiggen
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