Automatic product identification for the steel industry

Modern methods of pattern recognition have made it possible to automatically recognize imprinted characters even on red-hot, oxidized or welded surfaces of slabs, billets or finished steel products in industrial environments. The system for character recognition of the Bonn based company Systemforschung compares the results with those in the database of an in-house material flow system and documents them. Thus it is possible to consistently trace each product in the process chain from the steel works to the rolling mill. Such recognition systems have already been installed in several steel and rolling mills in Europe to eliminate mix-ups of billets or slabs.

Still up today reliable tracking of each product in the process chain has remained a big challenge in steel and rolling mills. This task is becoming even more important in regard to the call for consistent documentation and reliable quality assurance. Avoiding mix-ups and enabling back tracing of individual billets or slabs are indispensable preconditions for many steel processing companies, e. g. for those working for the automotive industry, and other companies that need high-quality steel.

As documented in various studies, metal stamping is a very reliable method to label the front faces of billets or slabs. In addition to being easily readable by humans, its resistance to subsequent processing and its non-critical surface quality demands gives metal stamping fundamental advantages over other marking methods such as stamped bar code, dot matrix code, labels, tags or colour markings.

Nevertheless to enable automatic reading of stamped characters on billets and slabs many challenging or presumably unsolvable problems had to be overcome. Overlapping characters, irregular intervals between characters, imprints with missing or broken outlines, surface scaling and thermal cuts could not be read by conventional OCR systems.

Systemforschung has now successfully developed an OCR system which is able to take care of all these problems
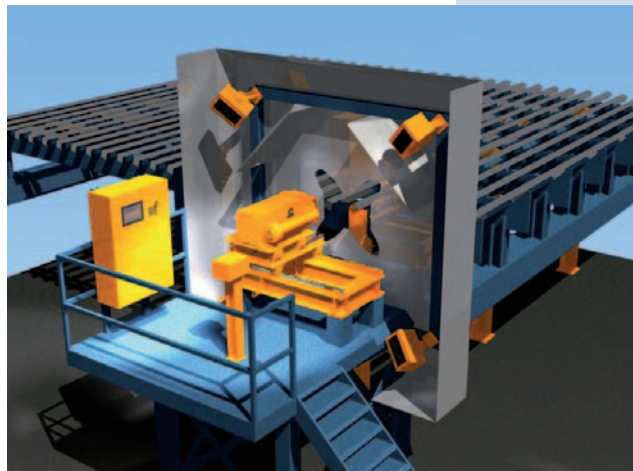
Figure 1. Schematic representation of the marking machine and the subsequent reading station at Mittal Steel Ruhrort, Duisburg, Germany
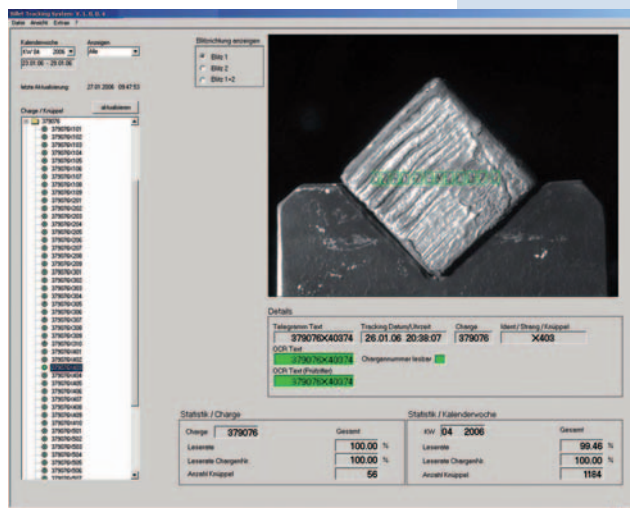
Figure 2. The visualization software allows the tracing or retrieval of individual billets

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and read imprinted characters with the described flaws. The system is based on modern methods of pattern recognition and adaptive classifiers - e.g. neural nets – as well as special exposure and illuminating techniques **(figure 1)**. Due to its flexible design it can be adapted to virtually any production conditions. For example, reading in motion or under vibration is possible with little demand on positioning accuracy. Imprinted characters can even be read on red-rot billets or slabs. In addition, the system also reads colour markings, bar codes or plain text.

All data are stored on a central database server where they can be matched and integrated into an existing material flow system. Dedicated visualization software allows online retrieval of each billet or slab including the reading results and single unit tracking of the entire production on one or several in-house PCs. This feature alone has often helped users to solve quality problems, making for a fast payback of the system.

Experience with installations at Saarstahl, Hoesch Hohenlimburg, Swiss Steel and Mittal Steel docu-ments a recognition reliability of up to 99 % of the billets or slabs **(figure 2)**. Check digits and "fingerprint methods" making use of weld marks and other characteristics support the reading and identification by the OCR even under unfavourable conditions. Damaged codes can be corrected. The high transparency of the billet and slab identification and tracking system of Systemforschung assist both the production staff and the management and provides further flexibility and increase in production. ■