Results of the studies showed that steels containing nickel in addition to chromium (e.g.,
steels 18CrNi8 and X10CrNi188) have a lower corrosion resistance.

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COMPUTER PROGRAMS FOR ENGINEERS AND METAL SCIENTISTS

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A review is given in this work of computer programs required in order to select alloy
composition and also in order to calculate properties connected with hardenability, poly-
morphic transformation parameters, microstructure, physical and mechanical properties of
steels at normal and high temperatures after heat treatment.

AMETA. This is a data bank for individual steel properties [1, 2]. The data for it
were collected in the laboratories of industrial sections for alloy quality control. The
data bank and software give the customer the possibility of evaluating differences between
measured properties and their values provided in standards.

The information system compares thousands of recorded versions. In order to collect
information blanks are used with printed data. Blanks are filled by specialists for check-
ing materials and heat treatment in metallurgical and engineering enterprises. Currently
the bank has data for steels of the following types: hardened, carburized, structural,
free-cutting, spring, and nitrided.

Each record contains the following groups of data:

1. Basic data [enterprise, drawing number, article name, product name, steel designa-
tion, load number, article weight and size (maximum and typical), volume of the prepared
batch of articles, and date].
2. Characteristics of the original article (metallurgical production method, type
of casting, hot or cold shaping method, heat treatment schedule).
3. Production technology (serial number, operation, production parameters).
4. Steel chemical composition (sample location, method of analysis, concentration
5. Tensile test results [test record number, typical section size, sample location,
specimen cutting direction, specimen type and size, operation serial number, test tempera-
ture, heat treatment schedule before testing, measured mechanical characteristics (relative
elongation and reduction of area, ultimate breaking strength, yield strength)].
6. Impact test results.
7. Hardness measurement data.
8. Results of Jominy tests concerning hardenability (serial number of the test record.
sample location, austenitizing temperature and duration, hardness value at a different dis-
tance from the surface).

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9. Other test data (metallographic and physical).

The system is implemented by means of a personal computer.

The software is based on the data base control system dBASE III. The computer program provides not only a search according to different strategies, but also graphical display, statistical analysis, and selection is also possible of the first, second, and third successive polynomial of the data.

Users may introduce their own data into the software and modify, erase, and display any of them on a screen.

**PREDIC AND TECH.** In spite of the fact that a data bank for individual measured properties of a steel includes thousands of records, a customer often requires data for alloy composition, production conditions, and dimensional combinations which are not in this bank. A system for extracting data (DDS) helps to overcome this problem. DDS includes computer programs for taking account of transformations during steel heating and cooling, prediction of the microstructure and properties connected with hardenability, etc. [3, 4].

Two DDS programs, i.e., PREDIC and TECH, are presented below. These programs are based on a phenomenological model of transformation kinetics typical for nonisothermal conditions. PREDIC program makes it possible to predict occurrence of transformations, a change in microstructure and mechanical properties as a function of time and position on a transverse section of a heat treated article.

Input data for the program are as follows: steel chemical composition; initial condition (hardened, hardened and tempered, annealed, normalized); heating atmosphere; article diameter; distance from the cooled surface; austenitizing temperature; heating time; cooling atmosphere.

The program simulates heating and cooling, it computes isothermal and thermokinetic austenite transformation diagrams by means of a recursive algorithm. Input data for the programs are as follows: $A_1$, $A_3$, $B_S$, $M_S$ temperatures; austenite grain size; microstructure and hardness after quenching; steel mechanical properties after hardening and tempering.

The TECH program operates similarly. The main idea of this program is planning of production heat treatment in order to realize the required combination of mechanical properties at a specific point of an article.

Both PREDIC and TECH programs may be used in machine building and metallurgical plants, and also in research and teaching establishments.

**KOPP.** This is an information system containing a data bank for 150 metallurgical structural materials, 300 corrosive media, about 15,000 individual data for the corrosion of alloys, and about 200 schemes of corrosive action.

This data bank includes the chemical composition of various steels, physical and mechanical properties, production data, address of the supplier, standards, comparative data for different countries, literature sources for each steel, and also the physical properties of a corrosive atmosphere. An individual data bank for corrosion includes the test results for corrosion of structural materials at different temperatures and corrosive agent concentration.

The software facilitates structural design. In order to manage the program there are instructions which are simple to assimilate. Structural materials may be selected from prescribed mechanical properties and anticorrosion characteristics.

Customers may introduce their own data into the software in order to change, erase, or put any data on the screen.

**EQUIST 1.1.** This is a computerized bank of comparative data for standard steels and a data bank management system which may be set up for operation by combined computers with IBM PC XT or AT, or IBM. The software only permits interrogation. EQUIST 1.1 contains the most important data for 5500 standard steels from 18 countries and also ISO and Euronom. The countries putting data into the bank are as follows: Germany, France, Great Britain, Italy, Sweden, Spain, USSR, USA, Australia, Japan, Hungary, Czechoslovakia, Poland, Yugoslavia, Bulgaria, Romania, and Finland.

The bank of EQUIST 1.1 contains the following data for each standard steel: designation; material number, country, standard, chemical composition (minimum and maximum concentrations for 15 elements); search field (apart from comments).