**http://www.metaltrade.ru/steelinfo/12x18n9t.htm**

**Марка стали 12Х18Н9Т**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Общие сведения**

|  |
| --- |
| Заменитель  |
| стали: 10Х14Г14Н4Т, 12Х17Г9АН4, 12Х18Н10Т.  |
| Вид поставки  |
| сортовой прокат, в том числе фасонный: ГОСТ 5949-75, ГОСТ 2590-71, ГОСТ 2591-71, ГОСТ 2879-69. Калиброванный пруток ГОСТ 7417-75, ГОСТ 8559-75, ГОСТ 8560-78. Шлифованный пруток и серебрянка ГОСТ 5949-75, ГОСТ 14955-77, ГОСТ 18907-73. Лист толстый ГОСТ 7350-77. Полоса ГОСТ 4405-75, ГОСТ 103-76. Проволока ГОСТ 18143-72. Поковки и кованые заготовки ГОСТ 1133-71, ГОСТ 25054-81.  |
| Назначение  |
| сварная аппаратура, трубы, детали печной арматуры, теплообменники, муфели, детали выхлопных систем, листовые и сортовые детали. Аппараты и сосуды, работающие при температуре от -196 до 600 °С под давлением, а при наличии агрессивных сред до 350 °С. Сталь коррозионно-стойкая, жаростойкая аустенитного класса.  |

**Химический состав**

|  |  |
| --- | --- |
| Химический элемент  | %  |
| Кремний (Si), не более  | 0.8  |
| Медь (Cu), не более  | 0.30  |
| Марганец (Mn), не более  | 2.0  |
| Никель (Ni)  | 8.0-9.5  |
| Титан (Ti)  | 0.6-0.8  |
| Фосфор (P), не более  | 0.035  |
| Хром (Cr)  | 17.0-19.0  |
| Сера (S), не более  | 0.020  |

**Механические свойства** Механические свойства

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Термообработка, состояние поставки  | Сечение, мм  | s 0,2 , МПа  | s B , МПа  | d 5 , %  | y , %  |
| Прутки. Закалка 1020-1100 °С, воздух, масло, вода.  | 60  | 196  | 540  | 40  | 55  |
| Прутки шлифованные, обработанные на заданную прочность.  | 1-30  |   | 540-880  | 20  |   |
| Прутки нагартованные  | <5  |   | 935  |   |   |
| Листы горячекатаные или холоднокатаные. Закалка 1030-1080 °С, вода или воздух.  | >4  | 216  | 530  | 38  |   |
| Поковки. Закалка 1050-1100 °С, воздух или вода.  | <1000  | 216  | 510  | 35  | 40  |
| Проволока термообработанная  | 1-6  |   | 540-880  | 20  |   |
| Проволока нагартованная  | 1-6  |   | 1080  |   |   |

Механические свойства при повышенных температурах

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| t испытания, °C  | s 0,2 , МПа  | s B , МПа  | d 5 , %  | y , %  |
| *Прутки диаметром 18-25 мм. Закалка 1050 °С, вода [170]*  |
| 20  | 280  | 620  | 41  | 63  |  |  |  |  |  |  |  |  |  |  |
| 300  | 200  | 460  | 31  | 65  |  |  |  |  |  |  |  |  |  |  |
| 400  | 180  | 450  | 31  | 65  |  |  |  |  |  |  |  |  |  |  |
| 500  | 180  | 450  | 29  | 65  |  |  |  |  |  |  |  |  |  |  |
| 600  | 180  | 400  | 25  | 61  |  |  |  |  |  |  |  |  |  |  |
| 700  | 160  | 280  | 26  | 59  |  |  |  |  |  |  |  |  |  |  |
| 800  | 100  | 180  | 35  | 69  |  |  |  |  |  |  |  |  |  |  |
| *Образец диаметром 10 мм, длиной 50 мм, прокатанный. Скорость деформирования 20 мм/мин. Скорость деформации 0,007 1/с. [81]*  |
| 800  | 155  | 200  | 27  | 57  |  |  |  |  |  |  |  |  |  |  |
| 900  | 110  | 120  | 41  | 90  |  |  |  |  |  |  |  |  |  |  |
| 1000  | 58  | 66  | 50  | 95  |  |  |  |  |  |  |  |  |  |  |
| 1100  | 35  | 38  | 66  | 99  |  |  |  |  |  |  |  |  |  |  |
| 1200  | 22  | 26  | 79  | 100  |  |  |  |  |  |  |  |  |  |  |
| *Лист толщиной 2 мм. Нагартовка со степенью холодной пластической деформации 60 \% [170]*  |
| 20  | 1290  | 1330  | 10  |   |  |  |  |  |  |  |  |  |  |  |
| 300  | 970  | 1080  | 6  |   |  |  |  |  |  |  |  |  |  |  |
| 500  | 780  | 870  | 10  |   |  |  |  |  |  |  |  |  |  |  |
| 700  | 360  | 420  | 29  |   |  |  |  |  |  |  |  |  |  |  |

Механические свойства в завис. от степени пластической деформации

|  |  |  |  |
| --- | --- | --- | --- |
| Термообработка, состояние поставки  | s 0,2 , МПа  | s B , МПа  | d 5 , %  |
| *Лист. Закалка 1050 °С, вода.*  |
| Степень обжатия 0 \%  | 280-400  | 550-650  | 40-50  |  |  |  |  |  |  |  |  |  |  |  |
| Степень обжатия 30 \%  | 900  | 950  | 12  |  |  |  |  |  |  |  |  |  |  |  |
| Степень обжатия 70 \%  | 1150  | 1250  | 3  |  |  |  |  |  |  |  |  |  |  |  |

**Технологические свойства**

|  |
| --- |
| Температура ковки  |
| Начала 1200, конца 850. Сечения до 350 мм охлаждаются на воздухе.  |
| Свариваемость  |
| сваривается без ограничений. Способы сварки: РДС электродами ЦЛ-11, ЦЛ-15 (обеспечивающие коррозионную стойкость), ЦТ-26 (используемый как жаропрочный без требований по МКК), ЭШС. Рекомендуется последующая термообработка.  |
| Обрабатываемость резанием  |
| В закаленном состоянии при НВ 169 и s B = 610 МПа K u тв.спл. = 0,85, K u б.ст. = 0,35.  |

**Ударная вязкость** Ударная вязкость, KCU, Дж/см 2

|  |  |  |
| --- | --- | --- |
| Состояние поставки, термообработка  | +20  | -70  |
| Пруток сечением 18-25 мм. Закалка 1050 С, вода. бв = 620 МПа, б0,2 = 280 МПа.  | 250  | 250  |

**Предел выносливости**

|  |  |  |
| --- | --- | --- |
| s -1 , МПа  | t -1 , МПа  | n  |
| 279  |   | 1Е+7  |
| 196-235  | 132  |   |

**Жаростойкость**

|  |  |  |  |
| --- | --- | --- | --- |
| Среда  | Температура, °С  | Глубина, мм/год  | Группа стойкости или балл  |
| Перегретый пар  | 600  | 0,0018  | 2  |
| Воздух  | 650  | 0,0022  | 2  |
| Воздух  | 750  | 0,013  | 4  |

**Физические свойства**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Температура испытания, °С  | 20  | 100  | 200  | 300  | 400  | 500  | 600  | 700  | 800  | 900  |
| Модуль нормальной упругости, Е, ГПа  | 195  | 189  | 182  | 175  | 167  | 180  | 153  | 143  | 135  |   |
| Плотность, pn, кг/см3  | 7900  | 7860  | 7820  | 7780  | 7740  | 7690  | 7650  | 7600  | 7560  | 7510  |
| Коэффициент теплопроводности Вт/(м ·°С)  |   | 16  | 18  | 20  | 21  | 23  | 25  | 26  | 28  | 29  |
| Уд. электросопротивление (p, НОм · м)  | 725  | 792  | 861  | 920  | 976  | 1028  | 1075  | 1117  | 1149  | 1176  |
| Температура испытания, °С  | 20- 100  | 20- 200  | 20- 300  | 20- 400  | 20- 500  | 20- 600  | 20- 700  | 20- 800  | 20- 900  | 20- 1000  |
| Коэффициент линейного расширения (a, 10-6 1/°С)  | 16.0  | 17.0  | 17.6  | 18.0  | 18.3  | 18.6  | 18.9  | 19.3  | 19.5  | 20.1  |
| Удельная теплоемкость (С, Дж/(кг · °С))  | 469  | 486  | 498  | 511  | 519  | 528  | 532  | 544  | 548  |   |

**Чувствительность к охрупчиванию**

|  |  |  |
| --- | --- | --- |
| Температура, °С  | Время, ч  | KCU, Дж/см 2  |
| -  | Исходное состояние  | 245  |
| 500  | 10000  | 186  |
| 550  | 20000  | 220  |
| 600  | 10000  | 215  |

 |