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STRUCTURAL AND SEMANTIC ANALYSIS OF API STANDARD TERMINOLOGY

СТРУКТУРНО-СЕМАНТИЧНИЙ АНАЛІЗ ТЕРМІНІВ СТАНДАРТІВ API

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The article presents a structural and semantic investigation of the terminological system of the American Petroleum Institute (API) standards, based on the material of API RP 13I. The growing scope of international technical standardisation has intensified the need for accurate and conceptually consistent translation of specialised regulatory documentation. In the oil and gas sector, where operational safety, technological reproducibility, and regulatory compliance are directly dependent on terminological precision, the internal organisation of technical terminology becomes a matter of critical importance. The study is aimed at identifying the dominant structural and semantic characteristics of API terminology and at determining their relevance for technically adequate translation into Ukrainian.

The analysis demonstrates that the terminological system of API standards is characterised by a high degree of formalisation, systemic coherence, and functional rigidity. It is established that the examined terminology performs classificatory, descriptive, and parametric functions within normative technical discourse. Particular attention is given to the mechanisms that ensure semantic specificity, structural predictability, and minimisation of interpretative variability in standardised documentation.

The semantic examination reveals a clearly organised internal stratification of terminological units according to their functional roles in technical communication. It is confirmed that API terminology tends toward maximal semantic unambiguity and procedural embeddedness. A considerable proportion of terms incorporates formally defined quantitative parameters, which significantly restricts permissible translation variability and necessitates the use of fixed technical equivalents.

It is substantiated that structural-semantic profiling constitutes an essential stage in the translation of technical standards, since terminological inconsistency may lead to technological inaccuracies or potential safety risks. The findings contribute to specialised translation studies and may be applied in translator training as well as in the practical translation of oil and gas regulatory documentation.

Keywords: API standards, structural-semantic analysis, technical terminology, oil and gas discourse, specialised translation.

У статті здійснено структурно-семантичне дослідження термінології стандартів Американського інституту нафти (API) на матеріалі документа API RP 13I. Актуальність роботи зумовлена розширенням сфери міжнародної технічної стандартизації та зростанням потреби у точному й концептуально узгодженому перекладі спеціалізованих нормативних документів. У нафтогазовій галузі, де технологічна безпека, відтворюваність виробничих процесів і відповідність регуляторним вимогам безпосередньо залежать від термінологічної точності, внутрішня організація технічної терміносистеми набуває особливої значущості. Метою дослідження є виявлення домінантних структурних і семантичних характеристик термінів стандартів API та визначення їх перекладацької релевантності для української мови.

У результаті аналізу встановлено, що терміносистема стандартів API характеризується високим ступенем формалізації, системною впорядкованістю та функціональною жорсткістю. З'ясовано, що досліджувана термінологія виконує класифікаційну, описову та параметричну функції в нормативному технічному дискурсі. Особливу увагу приділено механізмам забезпечення семантичної конкретизації, структурної передбачуваності та мінімізації інтерпретаційної варіативності у стандартизованих текстах.

Семантичний аналіз засвідчив чітку внутрішню стратифікацію термінологічних одиниць відповідно до їх функціональних ролей у технічній комунікації. Підтверджено, що терміни стандартів API тяжіють до максимальної семантичної однозначності та процедурної вмотивованості. Значна частина одиниць містить формалізовані кількісні параметри, що істотно обмежує варіативність перекладу та зумовлює необхідність використання фіксованих технічних відповідників.

Обґрунтовано, що структурно-семантичне профілювання є необхідним етапом перекладу технічних стандартів, оскільки термінологічна неузгодженість може спричинити технологічні похибки або безпекові ризики. Отримані результати поглиблюють теорію галузевого перекладу та можуть бути використані у підготовці перекладачів і практиці перекладу нормативної документації нафтогазової сфери.

Ключові слова: стандарти API, структурно-семантичний аналіз, технічна термінологія, нафтогазовий дискурс, галузевий переклад.

Problem Statement. The rapid expansion of international technical standardisation has significantly increased the demand for high-quality translation of specialised regulatory documents. In the oil and gas industry, where operational safety, technological consistency, and regulatory compliance are critically dependent on terminological precision, the translation of standards produced by the American Petroleum

Institute (API) presents particular challenges [3]. API documents are characterised by a high degree of formalisation, dense terminological structuring, and strict semantic unambiguity, which together impose elevated requirements on both linguistic and subject-matter competence of translators.

In contemporary translation studies, increasing attention is being paid to the structural and semantic properties of specialised terminology as a prerequisite for achieving equivalence in technical translation. However, despite the growing body of research on technical and scientific translation, the terminological systems of API standards remain insufficiently examined from a structural-semantic perspective, particularly in relation to their implications for translation practice.

Given the complexity and standardised nature of API terminology, a systematic analysis of its structural models and semantic organisation is necessary to ensure terminological consistency and reduce the risk of misinterpretation in translated regulatory texts. The present study seeks to identify the dominant structural configurations and semantic properties of the terminological units employed in API RP 13I [3] and to evaluate their implications for translation into Ukrainian in the domain of technical standardisation.

Literature Review. The theoretical foundations of specialised translation emphasise the central role of terminology as a carrier of domain-specific knowledge and as a key determinant of translation quality. Classical works in technical translation consistently highlight the importance of terminological accuracy and system consistency in specialised discourse. As noted by Karaban [2, p. 35], scientific and technical translation requires strict adherence to established terminological norms and minimisation of contextual variability that may be acceptable in general-language translation.

From a usability-oriented perspective, technical documentation must ensure clarity, functional adequacy, and user accessibility, which directly depends on terminological precision [4]. Within the functionalist paradigm, translation is viewed as a purposeful activity conditioned by communicative goals and target-text functionality [9]. This position is particularly relevant for highly regulated technical domains such as the oil and gas industry.

From a risk-management perspective, translation decisions may be interpreted as effort-driven operations in which controlled information reduction can function strategically; however, such tolerance is significantly restricted in safety-critical technical discourse [10, p. 92].

Recent cognitive approaches to terminology emphasise the conceptual structuring of specialised knowledge and the systematic organisation of domain-specific lexicons [5, p. 124]. According to ISO 704 (2009), terminological systems in specialised domains must ensure conceptual clarity, univocity, and systematic coherence. The importance of extralinguistic factors in terminological standardisation has also been highlighted in Ukrainian scholarship [1, p. 76].

Despite these advances, the terminological architecture of API standards remains insufficiently systematised in translation-oriented research, which necessitates targeted structural-semantic investigation.

Research Aim and Objectives. The aim of this study is to conduct a comprehensive structural and semantic analysis of the terminological system of API RP 13I and to determine its implications for the accurate and standard-compliant translation of technical terminology into Ukrainian. To achieve the stated aim, the study pursues the following objectives:

− to systematise the terminological inventory of API RP 13I and identify its dominant lexical-structural patterns;

− to classify the principal structural models of API terms (one-word, compound, and prepositional constructions);

− to analyse the semantic organisation of the identified terminological units, including their conceptual scope and intercomponent relations;

− to determine the functional roles of key semantic groups within the normative technical discourse of API standards.

Discussion. The American Petroleum Institute (API) develops regulatory documents characterised by exceptionally stringent requirements for terminological accuracy, structural uniformity, and semantic unambiguity. API standards incorporate complex multi-level terminological systems that reflect the physicochemical properties of materials, parameters of laboratory procedures, metrological characteristics of testing, and specialised technological processes.

API RP 13I constitutes a particularly representative corpus for structural and semantic investigation, as it encompasses a comprehensive set of terms related to drilling fluid laboratory testing, material property determination, technological operations, and performance evaluation parameters.

Given the multicomponent and systemically organised nature of API terminology, closer examination of the internal structure of terms and the principles governing their formal organisation is required. The structural dimension is foundational for subsequent semantic interpretation, since the formal configuration of a term largely determines its meaning, textual function within the standard, and translational behaviour. Accordingly, the analysis below focuses on the dominant structural models observed in API standards.

API terminology demonstrates a high degree of formalisation and adheres to the standardisation principle "one term – one concept." Within the analysed corpus, several dominant structural patterns can be identified.

1. One-word terms represent the most basic layer of the terminological system and denote fundamental physical or technological concepts (e.g., *abrasivity, viscosity, density, accuracy, precision, filtrate, spurt loss, autoclave*). These units typically occur in the sections *Terms and Definitions* and *Reagents and Apparatus* and function as semantic nuclei for more complex multicomponent constructions.

2. Compound terms constitute the core of the technical lexicon. They are predominantly realised through premodifying combinations of adjectives, nouns, and participles (e.g., *drilling fluid, non-aqueous fluid, base oil, simulated drilled solids, HTHP filter press*).

Such constructions provide classificatory, descriptive, and parametric specifications of technical objects, which is a defining feature of English-language engineering discourse.

The terms under study are mainly represented by combinations of adjectives, nouns and participles in preposition. These structures provide classification, descriptive and parametric characteristics of objects, which is a typical feature of English-language technical discourse. In oil and gas industry standards, they are used to accurately designate equipment, tools, technological processes, and the physical and chemical properties of drilling fluids.

− the Adj + N (adjective + noun) model often forms classification terms that describe a property or feature of an object, for example: *non-aqueous fluid – безводний (неводний) буровий розчин; synthetic base oil – синтетична базова олива; rotational viscometer – ротаційний віскозиметр; magnetic stirrer – магнітна мішалка; abrasion blade – абразивний ніж / лезо*

− the N + N (noun + noun) model – the first noun acts as a classifier, and the second as the core meaning. Such terms often refer to tools, equipment or technical parameters, for example: *drilling fluid – буровий розчин, filter press – фільтр-прес, particle size – розмір частинок, roller oven – роликовий термостат, aging cell – камера для старіння зразків.*

− the Participle + N model (participle + noun) – the first component describes the state, process of influence or method of processing the material, for example: *simulated drilled solids – імітовані тверді частинки вибуреної породи, calibrated cylinder – проградуйований циліндр, heated sample – нагрітий зразок, aged fluid – «постарілий» (після нагрівання) розчин, adjusted viscosity – скоригована в'язкість.*

Most of these terms are constructions that do not allow for abbreviation or variation, since changing even one component changes the technical meaning.

1.3. Terminological phrases with prepositional structures are widely used in API standards, especially in descriptions of methods, material characteristics, and testing procedures. They perform an important function: they clarify a property, parameter, quantitative characteristic, or object of study, ensuring maximum accuracy and scientific objectivity of formulations. Unlike simple and two-component complex terms, prepositional constructions represent a higher level of abstraction, as they describe not only the object, but also its attribute, relationship or function in the testing process.

Prepositional phrases in API standards most often describe: large abstract parameters such as loss of mass, increase in viscosity, measured characteristics of materials such as volume of filtrate, density of suspension, research or testing methods determination of abrasivity, measurement of gel strength, chemical processes and reactions extraction of solids, dissociation of ions, quantitative or qualitative changes reduction in particle size, change in alkalinity. All of these formats are typical for technical style, particularly for API engineering and laboratory standards

Below is a thorough step-by-step description of the models identified in the API standard under study.

− The N + of + N model is the most common structure that denotes the relationship between a parameter and a measurement object, for example: *loss of mass – втрата маси, volume of filtrate – об'єм фільтрату, rate of penetration – швидкість проникнення, measurement of viscosity – вимірювання в'язкості, abrasion of metal components – зношування металевих елементів.*

− The N + of + Adj + N model is a refined version of the previous structure, which conveys the nature of the object, for example: *cation-exchange capacity of drill solids – катіонообмінна здатність твердих частинок, volume of high-temperature filtrate – об'єм високотемпературного фільтрату, loss of water-based mud performance – втрата властивостей водо-базованого розчину, determination* *of non-aqueous fluid content – визначення вмісту неводної фази, stability of oil-continuous emulsions – стабільність емульсій з оливою як безперервною фазою.*

− The N + for + V-ing model indicates the purpose or function of equipment and procedures, for example: *apparatus for measuring density – апарат для вимірювання густини, equipment for preparing test samples – обладнання для підготовки зразків, device for evaluating abrasion – пристій для оцінювання абразивності, method for testing gel strength – метод для випробування гелевої міцності, container for heating drilling fluid – контейнер для нагрівання бурового розчину.*

− The N + in + N model is used to express the localisation of processes or characteristics, for example: *change in alkalinity – зміна лужності, increase in viscosity – підвищення в'язкості, reduction in particle size – зменшення розміру частинок, growth in filtrate volume – збільшення об'єму фільтрату, error in measurement – помилка вимірювання*

− The Determination/Measurement/Evaluation + of + N model is most commonly used in API standard structures, especially in method descriptions (sections 5–14), for example: *Determination of Abrasivity – визначення абразивності, Measurement of Shear Strength – вимірювання зсувної міцності, Evaluation of Particle Size Distribution – оцінка гранулометричного складу, Determination of Moisture Content – визначення вмісту вологи, Measurement of pH – вимірювання кислотності.*

− The N + of + V-ing model indicates a process that relates to another process or parameter, for example: *effect of heating – вплив нагрівання, result of stirring – наслідок перемішування, impact of rolling – вплив прокатування, rate of cooling – швидкість охолодження, degree of swelling – ступінь набухання.*

Prepositional constructions in the structure of API standard terms perform certain functions: they convey complex technological relationships (property – carrier, process – object of influence), ensure maximum specificity of the parameter, and unlike general English, API terms do not allow for variability, for example: volume of filtrate ≠ filtrate volume (which convey different concepts). Several prepositions can be combined: *Determination of the volume of filtrate after heat-aging.*

Therefore, terminological phrases with prepositional structures are one of the key features of the API standards terminology system. They ensure accuracy in the designation of processes, properties and parameters; structural predictability; unification of terminology; and the possibility of clear interpretation during testing and evaluation of results. They are widely represented mainly in the descriptions of methodologies (clauses 4.1–14.7).

1.4. Format and parametric terms – the standard contains a significant number of terms with parameters specified, for example: *600 r/min dial reading, 30 min ± 30 s stirring time, 350 mL laboratory barrel, particle size distribution (PSD), d50 particle mean diameter*. Such units are both terms and units of technical parameters, which is a specific feature of API standards.

Thus, structural analysis of API standard terms demonstrates a clearly organised model for constructing technical units, combining simple, complex and multi-component structures with established syntactic patterns.

However, the formal organisation of terms constitutes only one dimension of the overall terminological system. A comprehensive understanding of their functional behaviour requires closer examination of their semantic properties, including internal semantic structure, the nature of intercomponent relations, and the specific mechanisms by which physicochemical processes are terminologically represented. Accordingly, the subsequent stage of the present study focuses on the semantic analysis of API standard terminology, with the aim of elucidating the deeper conceptual content of the terms and clarifying their functional role within normative technical discourse.

Semantic analysis shows that the API standards terminology system has a clear structure, so we have identified several main groups, in our opinion:

− Terms denoting equipment and apparatus, for example: *mixer, viscometer, filter press, abrasion test blade, magnetic stirrer, aging cells, roller oven.* These terms are presented in the sections *Reagents and Apparatus* Semantically, they refer to technological means, but are often specified by detailed parameters: *diameter 36.5 mm*, *capacity 250 mL*, *accuracy ±0.01 g*.

− Terms for processes and procedures, for example: *mixing, agitation, rolling, heating, aging, boiling, titration, decanting, sifting.* All of them are used in the form of verbal nouns, which is typical for technical discourse.

− Terms relating to physical and chemical properties, for example: *density, relative density, viscosity, gel strength, pH, alkalinity, cation-exchange capacity, spurt loss, filtrate volume, abrasivity, moisture content.* Conceptually, this group represents measurable quantities.

− Terms of methods and tests, for example: *Low-temperature, low-pressure (LTLP) filter test, HTHP filtration, Deflocculation test, Methylene*

Blue Capacity test, Shale-particle disintegration test, Shear strength measurement (shearometer method). Each method in the standard has the status of an unambiguous term that is repeated in all API documents of the corresponding series.

− Abbreviated terms, for example: *HTHP, LTLP, PSD, ISE, PAH, NAF, ISA, PPA, PPT, UV*, listed in the 'Abbreviations' section. Abbreviations form the core of the formalised terminology system, and their semantics are strictly unified.

After conducting a thorough analysis, we can conclude that API standards demonstrate three key semantic trends: terms demonstrate maximum clarity of meaning, for example: *spurt loss – об'єм рідини, що проходить через фільтрувальний матеріал до утворення фільтраційної кірки*. The term does not allow for any other interpretation.

Most terms have a procedural component, for example: *initial performance filtration test, low-temperature filtration testing after heat aging, operational check of electrode system, hot-rolling procedure.* The term refers not only to a concept, but also to a strictly regulated sequence of actions. This brings the terms closer to instructional formulas.

The term has a formal mathematical meaning, for example: *abrasivity (a)* is determined by the formula $mb - mf / t$. Such units cannot be translated descriptively – only by a fixed technical equivalent.

Structural-semantic analysis shows that: API terms are mostly structurally compound, but semantically unambiguous; structural components, for example: *oil-based, water-based, high-temperature, low-pressure* perform a classification function; the number of translation options is minimal due to standardisation; translation requires internal unification of the terminology system, consistent with API and ASTM, for example, *base oil* should be translated as *базова олива*, not as *основна олива*, since only the first option corresponds to the terminology system of API standards.

Thus, the terminology of API standards forms a complex, multi-level structure in which lexical, morphological, syntactic and parametric models are distinguished. The semantics of terms is focused on unambiguity, reproducibility and technological accuracy. API standards demonstrate a tendency towards maximum formalisation of the terminology system, which is typical for international standardisation. Structural and semantic analysis of terms is a key stage in the preparation of translations of technical standards, as semantic inaccuracy can lead to technological or safety risks.

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